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Die-castings

We have often wondered why die-casting is considered to be a business quite separate from the general run of foundry practice, just because it uses a metallic mould. With the exception of steel, the process uses the same series of alloys, though its application to iron and copper-base castings is confined to relatively few irons, and more-specialized methods. In the case of iron, die-casting is extensively used for the production of pipes (by the centrifugally casting method), of gutters (by rapid pressing of the liquid metal), and on turntable machines for the mass production of a wide variety of engineering components. It is truthful to state that the producers of these castings have but little to do with what the average engineer deems to be the business of die-casting.

There are two main commercial divisions of the ordinary types of die-castings—those made in light alloys and those which are zinc based. In the former category, aluminium die-castings are produced to a much greater extent than sand castings and over the last decade the gap has widened in favour of die-castings. Production of the second type, that is, the zinc-base die-castings, is going ahead under the enlightened leadership of the Zinc Alloy Die Castings Association. In the field of publicity for their products, this body is most active and we were particularly impressed with a pamphlet recently issued entitled "Questions and Answers." Illustrated replies are given to the questions "How Many?"; "How Few?"; "How Large?"; "How Small?". Here a picture is shown of castings which go 94 to the ounce (in contrast perhaps to small iron castings—malleable shoe-studs—which require about 40 to the ounce. The questions continue with "How Thick?", "How Thin?", "How Strong?", "How Delicate?", "How Complex?", "How Simple?", "How Rigid?", "How Ductile?". Thus the engineer, having digested this well-set-out information, only needs to know "How Much", and "How Quickly."

It is possible that the lack of interest shown in die-castings, as a subject for discussion by the ordinary foundryman, is that in the past, metallurgy, the vagaries of sand, and the production of metal suitable for casting have formed the main topics at technical meetings. However, since, in recent times, high production has been to the forefront of foundry practice, the science of engineering has become of major importance, and here undoubtedly, a new platform should be created where die-casters could take the lead in expressing their accomplishments, their needs and their difficulties. Die-casting was amongst the earliest methods for the mass production of engineering and other components, and to-day, we still doubt whether for speed and simplicity—once the machine is functioning satisfactorily—it can be surpassed.

Purchasing Seminars

The Purchasing Officers Association, in association with the European Productivity Agency, will be holding a series of purchasing seminars in London, Birmingham, Manchester, Belfast and Glasgow during January and February, 1958. They will be conducted by Mr. H. Lee Weber, B.SC., purchasing consultant to the European Productivity Agency. To provide sufficient opportunities for each seminar member to take an active part in discussions it is proposed to limit the size of each of the seminars to about 20 persons. Briefly the programmes are intended for two types of participant. Those for general management personnel (one-day) include such items as management and purchasing department co-operation; stores control; purchasing reports to management; and value analysis. Those for middle-grade buyers (two-days) will deal with the organization of the purchasing departments as to quality and quantity; inventory costs and records, sources of supply and vendor relations and (here also) reports to management and value analysis.

The fee for attendance at each type is 3½ guineas per day, including morning coffee, luncheon and tea. Applications for inclusion in the seminars should reach the secretary of the Purchasing Officers Association (Wardrobe Court, 146a, Queen Victoria Street, London, E.C.4) is possible by December 31. A detailed programme is available from the same address.

Forty Years Ago

In the December, 1917 issue of the JOURNAL, the Editor devoted his leading article to announcing the formation of a Conjoint Board of Scientific Societies. Herein were associated all the main engineering, medical and cultural bodies in this country. Amongst the ten sub-committees formed were: (No. 4) the Watching sub-committee on education; (No. 5) the sub-committee on the prevention of overlapping among scientific societies; (No. 6) the metric system sub-committee and (No. 10) the sub-committee on timber for aeroplane construction. The others were equally diverse and interesting. As this board is not known to the writer, it probably died on the advent of peace. Under "Trade Talk," there was a reference to the acquisition by the Eyre Smelting Company, Limited, of the Tandem Smelting Company, Limited, of Merton Abbey, London, and the transference of their head office to these works from Tonbridge. Amongst new companies registered appeared the names of Neville Foundry Company, Limited, of Rotherham, and David Adams and Sons, Limited, of Cradley Heath.

Import Duties Board Proposal dropped

Pressure from MPs and industry has decided the Government to abandon the proposal to establish an Imports Duties Board to advise the Board of Trade on tariff rate changes. Amendments to the Import Duties Bill tabled by Sir David Eccles, President of the Board of Trade, delete from the Bill all references to the advisory board. Industrialists are likely to continue to have direct access to the Board of Trade to ask for changes in duty and these will be considered in the light of the criteria set out in the Bill.

A new clause provides that, beginning with the year 1959-60, the Board of Trade shall lay before Parliament a report on the exercise of powers conferred by the Act "with respect to the imposition of import duties and the allowance of exemptions and reliefs from import duties."

City and Guilds Results

The City and Guilds of London Institute have made available the following statistics of the results of examinations for students of foundry practice and pattern-making for 1957 (with earlier figures for comparison):—

Examinations in Foundry Practice.

Intermediate.

Year.	Candidates.	First class.	Second class.	Passes, per cent.
1957	365	75	227	82.47
1956	381	109	216	85.7
1955	352	64	211	78.2
Final.				
1957	275	61	156	78.1
1956	239	48	145	76.7
1955	174	39	91	74.7

Examinations in Patternmaking.

Intermediate.

Year.	Candidates.	First class.	Second class.	Passes, per cent.
1957	441	59	252	71
1956	467	75	262	72.6
1955	463	69	253	69.4
Final.				
1957	341	45	175	64.6
1956	283	64	156	78.1
1955	265	49	140	71.3

Canada's "Reservoir of Goodwill"

"Defeat inflation, maintain steady costs and prices—better still, reduce them—and we have nothing to fear in the world's markets," said Sir David Eccles, President of the Board of Trade, when he spoke at the 175th anniversary dinner of the Glasgow Chamber of Commerce on December 13. If industry showed an all-round sense of responsibility during the coming winter, he thought the trading figures for the next six months should make good reading. He also believed British industry was becoming more export-minded, perhaps because the European Free Trade Area had made more firms think about foreign markets.

Referring to the European Free Trade Area, Sir Robert Maclean, president of the chamber, in reply said: "Some of us will gain, some of us must lose; many of us don't quite know where we will stand." He urged full support for the scheme, subject only to Commonwealth interests.

Concern over the fall of British exports to Canada was expressed by Mr. James S. Duncan, deputy leader of the trade mission. From what the mission had seen, he said, he was confident that Britain could supply Canada with a much larger proportion of the things it imported. In spite of the geographical handicap, Britain had the advantage of price and quality and an immense reservoir of goodwill. "If you establish yourself now, you will never regret it," he said.

Wholesale Prices continue to Fall

Further 1.7 per cent. fall in the wholesale prices of basic materials between October and November is reported, mainly due to lower prices for, among other items, lead, imported steel scrap, and zinc. These were slightly offset by higher prices for a number of items including copper, raw jute, and linseed oil.

The indices for materials used in the engineering industries showed little change in November, but the index for fuel used in manufacturing industry showed a slight increase. The index for all manufactured products showed no change compared with the figure for October.

Applications of Statistical Control in the Production of Precision Castings*

By V. di Sambuy

As a result of a paper given at last year's Investment Casters' meeting, the Author was so impressed by Mr. J. J. Tiedema's report concerning applications of mathematical statistics at Werkspoor's "Microcast" foundry, that he commenced statistical control in his own plant in Italy. In the paper which follows are some of the results obtained by the application of this technique which may help in solving the type of problems which confront foundrymen generally in producing precision castings.

In this application of methods of statistical control to the manufacture of precision investment castings, it is presumed that the reader already has an understanding of statistical control generally. On this basis, first, the standard deviation of the wax-injection process was considered through the examination of 25 samples of four variables using $\bar{X}$, R charts (see Table I and Fig. 1). The following facts emerged:—

(*a*) The standard deviation had generally been expected to be larger on dimensions crossing the parting line of the die, but in contrast with this opinion, it was noticed that dimensions lying completely in one half of the die and those passing across the die separating surface had R ranges always of the same order. Far more important to the dimensional stability of the casting was the deviation from the average $\bar{X}$ caused by defective construction of the die and/or of permanent deformations of one or more of the cavities, due to wear or flow of the soft white-metal used for die construction.

(*b*) The dimensions and therefore the average do (1) change for different waxes and for different time or temperature of injection; (2) decrease while the die temperature increases (see Table I). This Figure represents the trend of the average during the day; the mid-day stop for lunch being clearly noticeable. Fig. 2 represents the temperature diagram during the day, measured near the surface of the cavity considered in the run recorded in Table I and Fig. 1.

(*c*) Standard deviation for the wax-injection cycle is, as far as the Author's experience is concerned, smaller than found by Mr. Tiedema (see Fig. 3), $Y = 0.0017X + 0.04$, is considered as being normal, when X is the nominal size in mm.

(*d*) Smaller standard deviations can be obtained using wax chills or extensive coring, especially for cylindrical shapes; both these elements reduce the shrinkage of the wax, with the result that averages go up while ranges go down. In some cases this procedure may reduce standard deviations by 50 per cent.

(*e*) Water chilling (hardening) of wax patterns has no effect on standard deviation.

Principles Applied

Working on these principles, a number of standard deviations have been determined for wax patterns for a certain number of cavities in routine-production dies. After control limits have been fixed, a normal $\bar{X}$-R chart is now used for every wax-injection press—on each machine during the day, 16 waxes are measured (four samples from four patterns) after chilling them in water to room temperature, and the values observed are recorded on the control chart. It is surprising to note the many causes which push the process outside the control limits, *i.e.* wax or die temperature, injection time, etc.

Standard Deviations

Next, the standard deviations of the metal-casting process was studied. This was a far more difficult problem than the previous one, due to the great number of variables involved. After many experiments, the following fundamental facts emerged:—(*a*) The temperature of the mould has more significance than metal temperature on the dimensions of the castings, *i.e.* temperature of the preheating furnace definitely affects the deviation from the average; (*b*) static pressure at the feeder head is of noticeable importance; a normal trend of the dimensions on a cluster are of type A (Fig. 4), but sometimes they are of type B if the cavities at the periphery are cooler than the internal ones, for example, due to air cooling of the mould before casting. Nevertheless, even considering only the pieces cast on one cluster (thus avoiding the influence of temperature differences) and at the same height (to avoid the influence of static pressure), an abnormal distribution curve was noted, showing that more than one variable still influences the process at this stage. This particular problem is now being studied at the Author's firm to reduce the ranges and therefore improve the tolerances of their process. Application of statistical control are not limited to $\bar{X}$, R charts. In order to control the quality of production, the firm keeps "P" charts (see Table II), which record reject percentages for every batch of castings each day.

It is interesting to record that the firm of Westinghouse, in the USA, has approached the problem of tolerances in investment castings by considering the effect of the magnitude of the surface area, emphasizing the wide difference between the tolerances on small and large areas, and between rigid and non-rigid (for example, horseshoe) shapes. The Author quotes from the bulletin 52-500 issued by the materials manufacturing department, at the Blairsville plant of the Westinghouse Electric Com-

* Paper presented at the conference of the European Investment Casters Association at Stratford-on-Avon. The Author is a member of the *Associazione Italiana di Metallurgia*, Milan.

TABLE I.—*Typical* $\bar{X}$, *R Chart for Precision Investment Casting* (*see Fig.* 1).

	Calculated natural tolerance (measured in 0·01 mm.)						
	$\frac{\eta}{N}$	*a*	*b*	*c*	*d*	Σ	R
0800 hr.	1	32	31	30	30	123	2
	2	30	28	28	26	112	4
	3	27	28	27	27	109	1
	4	27	27	27	29	110	2
	5	27	27	26	27	107	1
	6	27	26	26	27	106	1
	7	26	27	27	26	106	1
	8	28	27	27	26	107	2
	9	26	26	25	28	105	3
1200 hr.	10	26	25	26	26	103	1
1300 hr.	11	30	29	28	25	112	5
	12	26	26	25	25	102	1
	13	25	25	25	24	99	1
	14	25	26	24	23	98	3
	15	25	25	25	23	98	2
	16	25	26	25	23	99	3
	17	23	24	24	24	95	1
	18	25	25	24	24	98	1
	19	25	24	24	24	97	1
	20	24	23	24	25	96	2
	21	24	23	24	23	94	1
	22	24	24	24	24	96	0
	23	24	23	24	23	94	1
1730 hr.	24	24	24	24	23	95	1
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	Totals					2,461	41

MOU CSQ 21

Microfusione Italiana SpA.			C.S.Q.	Date 23/11	Operator Post	No. 85318
Symbol No.	Wax.		Steel.		Dispersion quota.	
Zero quota	5.5 mm.		—		Remarks	
Quality of wax	2,575					
Machine or furnace ..	//					
No. of chill or cluster ..	//					
No. of impression or position	0					
Cooling	With	Without				
Level of chill	=	⊥				
Temp. of chill or state (see diagram)						
Temp. of wax or metal ..	//					
Refractory	//					

Calculation table	N		24	22	Per cent.	Diagram
Mean of the sums	$\bar{\Sigma} = \Sigma\Sigma/N$		102,55	10,107		
Av. dispersion ..	$\bar{R} = \Sigma R/N$		1.7	1.46		
Control limits ..	3	2.57 R				
	4	2.28 $\bar{R}$	3.9	3.3		
Natural toler ..	3	TR		4.25		
	4	3.54 $\bar{R}$ / 2.92 R				
Average value ..	$M = \Sigma/\eta$			25.2		
Modified level ..	Shrinkage coefficient//		Mean displacement//			
Control Limits ..	3	$\Sigma +$ 0.86TR	105.3			
	4	$\Sigma + TR$				
Sum	3	$\Sigma -$ 0.86TR	96.8			
	4	$\Sigma - TR$				

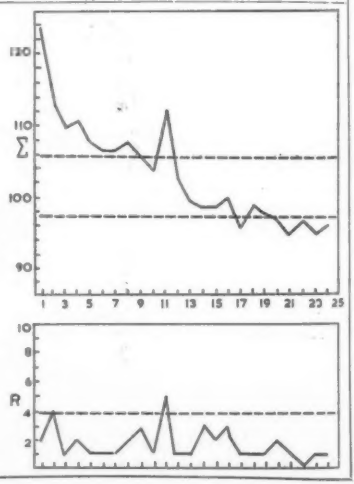

FIG. 1—*Control diagram resulting from the* $\bar{X}$. *R. variation shown*

TABLE II.—*" P " Chart for Daily Record of Castings Produced.*

MICROFUSIONE ITALIANA S.p.A.	C.S.Q.	Per cent. Control Deviations....	Month	Operator	Standard Dimensions	Per cent. Shrinkage .....
Customer	Component	Dispersions	Type of metal	Adjusted Av. Monthly Prodn.		

Pat. CSQ 3—V.57

Per cent. Deviation of the Batch: 44, 40, 36, 32, 28, 24, 20, 16, 12, 8, 4, 0

(*Space for Entries*)

Date		Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Castings per batch													
Reasons for deviation		When the Deviation Exceeds the Highest Permissible, inform the Production Office.											
		Production			Deviations					Per cent.			
Total													

pany as follows: " The order of tolerance can be predicted on the basis of data gleaned from experience from similar sizes and shapes. Tables (III and IV) show the best tolerances which may be held on various sizes of parts and are based on a typical casting (shown in Fig. 5). All tolerances shown include flatness variations on each surface.

TABLE III.—*Tolerances for Dimension " A " for Various Sizes of Parts. (See Fig. 5.)*

Dimension A. Inches.	Area of surface M in square inches.					
	Below 0.1 (basic).	0.5	1.0	2.5	5.0	8.0
Below 0.5	0.004	0.006	0.008	0.011	0.015	0.020
1.0 ..	0.005	0.007	0.009	0.012	0.016	0.021
2.0 ..	0.008	0.010	0.012	0 015	0.019	
3.0 ..	0.011	0.013	0.015	0 018	0.022	
4.0 ..	0.014	0.017	0 019	0.022		
5.25..	0.018	0.021	0.023			
7.0 ..	0.024	0.027				

If flatness is not necessary, but only specific points on a surface are functional, then a figure closer to the basic tolerance is applicable."

TABLE IV.—*Tolerances for Dimension " B " for Various Sizes of Parts. (See Fig. 5.)*

Dimension B. Inches.	Area of surface N in square inches.					
	Below 0.1	0.5	1.0	2.5	5.0	8.0
Below 0.5	0.006	0.008	0.010	0.013	0.017	0.022
1.0 ..	0.008	0.010	0.012	0.015	0.019	0.024
2.0 ..	0.011	0.013	0.015	0.018	0.022	
3.0 ..	0.015	0.017	0 019	0.022	0.026	
4.0 ..	0.018	0.021	0.023	0.026		
5.5 ..	0.023	0.026	0.028			
7.0 ..	0.030	0.033				

All figures in the tables are ± inches. Blank spaces indicate that the size is out of practical casting range.

As a final recommendation, the Author points out that, similar to its Specifications Sub-committee, the European Investment Casters Association could with advantage appoint a dimensional-tolerance

sub-committee in order to define the various tolerance classes which should be mutually acceptable and draw up specifications for distribution to customers of the various investment casters.

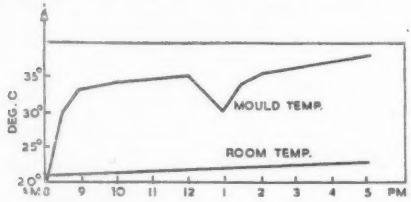

FIG. 2.—*Typical variation of investment-mould and room temperatures throughout a day's operations.*

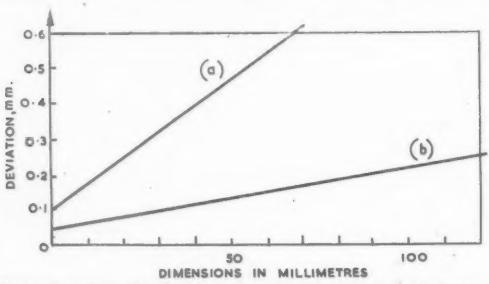

FIG. 3.—*Standard deviations to be expected from wax patterns; (a) according to Tiedema and (b) according to the Microfusione Italiana* (Y = 0.0017X + 0.04).

DISCUSSION*

MR. L. N. HOCKING (Trucast, Limited) asked if the author could also give actual figures of size variations occurring between the die cavity and the wax model and also those from the wax model to the final casting. Where did he find that the larger variation occurred, in the production of a wax model or during the casting cycle?

MR. DI SAMBUY said that in last year's paper by Mr. Tiedema* it was emphasized that the greatest problem in securing repetitive accuracy was that of injection, and tolerances in wax models represented more than 50 per cent., probably 60 per cent., of the standard deviation. In the work described in his own Paper, however, it was found that wax tolerances represented only 25–30 per cent. of the standard deviation of the items tested.

MR. A. DUNLOP (Foundry Services, Limited) asked if the "P" curve which had been described represented percentages of scrap.

MR. DI SAMBUY said it represented types of rejects.

MR. DUNLOP commented that that was more important, of course, and asked if the Author could classify the rejects.

*Mr. Tiedema's paper is contained in the *Proceedings* of the 1956 Precision Investment Casting Conference held in Holland.

THE AUTHOR replied that wax rejections were of little importance and were not taken into consideration. He and his colleagues regarded moulding defects and dimensional rejects as being the more important. They also took into account other causes, *i.e.*, rejects in respect of inclusions, shrinkage, and so on. The results obtained in the long run were helpful to find out optimum casting and clustering techniques.

Parting-line Variation

THE CHAIRMAN said he believed it was stated by the Author that the standard variations over the parting line were in general smaller.

MR. DI SAMBUY said they were not bigger; normally they were of the same order.

THE CHAIRMAN asked if that was a result of greater attention being given to the parting surfaces. Did Mr. di Sambuy and his colleagues grind the mating faces of the dies or give them some special preparation, or were they using tin/bismuth dies?

THE AUTHOR confirmed that both tin/bismuth, and surface-ground steel dies were used. If the die were well built, the pressure was applied rightly, if the surfaces were clean and there was no wax in between them, then all should be well.

MR. D. H. ARMITAGE (P.I. Castings (Altrincham), Limited), commenting on the Westinghouse system to which the Author had referred, asked whether it was suggested that tolerances should be

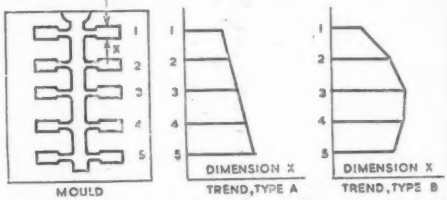

FIG. 4.—*Influence of static pressure and cavity temperature.*

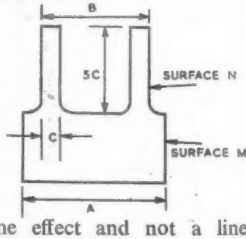

FIG. 5.—*Standard test casting (see Tables III and IV).*

expressed as a volume effect and not a linear effect, which was the more popular method. If so, he thought it was indeed a forward step, because he also considered that dimensional variations could be more correctly related to a volume effect.

MR. DI SAMBUY said the Westinghouse system did not consider volume, but the area of surface (in square inches) was considered as limiting the dimensions. As described in the earlier paper, for every class of surface and every class of linear dimension, a curve was drawn so that there

(*Continued on page 758*)

Equipment & Supplies

Drill Guard

A safety guard for radial arm drills (Fig. 1), patented by Newton, Chambers and Company, Limited, of Thorncliffe, Sheffield, it is claimed neither hinders production nor interferes with the movements of the operative, yet, the operator is fully protected from the moving spindle, the chief cause of accidents. The guard was developed and tested in the workshops of Newton, Chambers Engineering Division, where the need for such a device led to its invention by Mr. L. Crookes, the company's mechanical maintenance engineer. It fully covers the requirements of the Factories Acts and is now going into full production. The special feature of the invention is a system of spring-loaded fingers which assume any shape on the machine table. Despite the fact that the moving drill spindle is covered, there is no restriction of vision, and swarf cannot accumulate. Any length and size of drill may be used and drill changing is quick and simple. The guard may quite simply be clamped to the lower portion of a machine sleeve, and is supported by a bearing from the spindle. It remains quite firm whatever the drilling operation. Moving with the reciprocating sleeve, the appliance still remains effective whatever the extension of the sleeve or barrel.

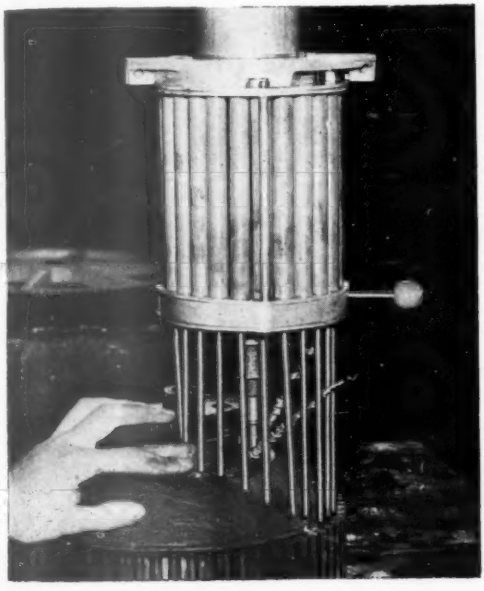

FIG. 1.—*Drill-protection device consisting of a cage of retractable spring-loaded pins, developed by Newton, Chambers & Company, Limited.*

Shot-blast Helmet

Interest in the foundry industry is increasingly focused on safety equipment which is no less efficient through being comfortable to wear. Thus the announcement of a new fibre-glass helmet for shot-blasters by Heafield Marketing Company, Limited, Spa Lane, Derby, would seem to be opportune. The fibre-glass helmet is constructed of woven-glass matting bonded by resins into the design shape, the resins being selected to provide a maximum resistance to abrasion and to wet heat, consistent with strength and lightness. The need for abrasion resistance is obvious. The relatively high thermal accommodation is to ensure that the helmet itself can be sterilized by wet steam, or by quick immersion in boiling water, or —since the resins are chemically inert—by any of the usual sterilizing solutions.

A head-rest is held in place by two press-stud fixings, the apron is tailored to fit on the lower edge and is held in place by a beading and sealed by a wide PVC or rubber band and all of these items can be easily and quickly removed from the helmet when required as, for example, when cleaning it. The double windows of the helmet are held in place by an appropriate groove in a plastic moulding; both can be removed by easing out of this groove. The first or outer window is intended to be a guard for the second, thicker window and can be readily discarded and replaced when too badly marked for adequate visibility.

Sited on the top of the crown is a rear-facing nozzle and a reversed comb, which forms a gradually expanding air-duct, terminating immediately above the window in a narrow slot. The nozzle will take 6- to 8-mm. dia. air-hose and by this means, ventilation is provided for the operator at the correct position for breathing and prevention of misting of the window is secured without objectionable or uncomfortable direct air currents or noises. In other words, the air input is evenly distributed throughout the helmet. There is a fitment on the cape at the waist for clipping the air pipe and so relieving the weight from the crown of the helmet, which overcomes any tendency for the helmet to slip on the head when in use.

Pore-space Measurement

The size and number of pores in materials make an important item in certain industries. When the size and number of pores in many materials are known, the quality and performance of the product can be accurately predicted. This applies to any substance that has pores—metals, fuels, plastics, chemicals, textiles, leather, building materials, ceramics, and many others. A new portable porosity-testing machine recently announced by the American Instrument Company, Inc., of Silver Springs, Md., and briefly described in *ASTM Bulletin*, July, measures the sizes of pores in any material with pores ranging from 0.1 mm. to 0.06 μ, and determines pore volumes as small as 0.0005 ml. at each pore diameter.

The instrument works on the principle that mercury will penetrate any porous material if sufficient pressure is applied. Initially an experiment is run by placing a small specimen of the material to be tested within a glass enclosure. Only pressures below atmospheric are used to force mercury into the pores while the specimen is kept thus enclosed. To measure very small pores the specimen is moved to a vertically sliding, stainless-steel pressure vessel and pressures of up to 3,000 lb. per sq. in. are applied to the sample. Pressure is fed to the testing vessel through a series of stainless-steel tubes. As pressure is raised, mercury is forced into smaller and smaller pores, the volumes of which are continually being indicated by the mercury level as it drops in the calibrated container.

Crushing Rolls. In list No. 486, Hadfields, Limited, East Hecla Works, Sheffield, describe and illustrate a series of machines for crushing iron-ore, ballast, and similar materials. It is a well-produced 20-page brochure.

Notes from the Branches

Slough Section

The Slough section of the Institute of British Foundrymen were unlucky in getting a foggy night for their December meeting. However, a small but very interested audience listened to a lecture given by Mr. J. Bain of Paterson Hughes Engineering Company, Limited, on a very topical subject, namely "Mechanization on a Modest Scale."

Mr. Bain, who illustrated his paper with about 20 slides, commenced by giving a general outline of what mechanization is and why it is embarked upon. All foundries, he said, whether large, small, jobbing or high-production, can benefit from mechanization in some way or other. One of the main factors to be borne in mind, however, when planning a layout for any foundry plant is flexibility; this is very important if the foundry is to meet the ever-changing conditions encountered in the industries served.

Simple Units

The main objective of the paper was to describe some of the less complex units designed to assist foundrymen, and also to show some simple but effective layouts suitable for the small foundry. Mr. Bain pointed out that it was possible to over-mechanize, especially when laying out a jobbing foundry. Over elaboration could defeat the objective and the final state of the shop might, from a production point of view, be worse than before. Though a foundry may be made a cleaner and healthier place in which to work, unless it produces more and better castings, the cost cannot ever be recovered. Mechanization should "take the sweat from the moulder's brow" by bringing him the sand, taking moulds to the pouring stations, etc. If a single pouring station be used it helps also in the fume-removal problem. Mr. Bain paid particular attention to use of the roller conveyor; this is used considerably in foundries, but in many cases with a low standard of results due to bad installation. In the early days, rollers which were quite unsuitable for the foundry were frequently used, but Mr. Bain reported that it was now realized that special designs were needed and were in fact now available from manufacturers.

Summing up, Mr. Bain pointed out that every foundry has its own particular problem and no standard layout could be offered, and whilst the incorporation in a layout of standard units of plant might be cheaper in the first place, a scheme designed for the particular needs of each foundry would give best results in the end.

An interesting discussion followed, after which the chairman Mr. A. R. Parkes thanked Mr. Bain on behalf of the section for his very interesting paper and apologized to him for the small assembly—due entirely, he felt sure, to the horrible weather conditions.

A PENSION SCHEME for the 10,000 employees at the Hawarden Bridge steelworks of John Summers & Sons, Limited, is to be introduced from next April, according to an announcement by the chairman, Mr. Richard F. Summers. Past employees of the company who are already in retirement and who retired at the age of not less than 65 after not less than 20 years with the company are to receive increases in the *ex gratia* payments already being made to them.

Trevelyan Scholarships

Broad Basis for Candidate Selection

A number of industrial companies and representatives of Oxford and Cambridge Universities and of public and grammar schools have agreed to provide financial support for scholarships of a new kind to enable selected boys to attend Oxford and Cambridge Universities. They will be known as the Trevelyan Scholarships and will be open to boys of British nationality receiving full-time education at schools in the United Kingdom and will be subject to successful candidates securing admission to one of the colleges at Oxford or Cambridge. Their value will be £450 per annum for three years, extended to four years in exceptional circumstances, and will not depend on parents' income. Promises of financial support from industrial companies have already been made which will ensure that 12 to 14 scholarships can be awarded annually at each university for the initial five-year period of the scheme.

In making these awards, the sponsors believe that there are boys capable of great contributions to the community whose capabilities cannot find full expression under the established examination system, although they possess high personal qualities and high intellectual ability. The sponsors hope that these scholarships will encourage boys to pursue a broader range of studies in the sixth form, whether related to their own special subjects or not without impairing their chances of going to a university through lack of financial support. With these considerations in mind, the selectors for the Trevelyan scholarships will look for evidence that a candidate can both profit fully from an honours course and show that he has undertaken some exacting task or project. This might be a purely intellectual enquiry or one involving personal observation and travel.

It is intended to make the first selections in November, 1958, by a committee consisting of representatives of Oxford and Cambridge Universities and industry. A steering committee has been established, the members of which represent industry, schools, and the Universities concerned. The chairman is Sir Walter Benton Jones, and Mr. R. Peddie, of 17, Westbourne Road, Sheffield, 10, is secretary.

Statistical Control in Precision Casting—Discussion

(*Continued from page 756*)

were seven curves with 42 steps. Furthermore, when the surface to be considered did not surround a compact volume, but an open one instead, another set of curves had to be applied.

Mechanical Properties

MR. G. LYON (Fairey Aviation Company, Limited) asked if the author also used statistical control for the mechanical properties of his castings and, if so, how did the coefficient of variation compare with that of the other factors—dimensions, etc.

MR. DI SAMBUY replied that he had not proceeded far in that direction yet. He had started statistical control applied to impact testing at low temperatures, because NATO officials were interested in them. However, it was part of his intention to proceed to statistical control by using both tensile and impact tests.

Water-soluble Cellulose-ethers as Binders for Foundry Purposes*

By Rolf Morén

[ABRIDGED]

After reviewing the nature of these types of binders, the Author describes their properties when used for coremaking. Generally, preference is given to using them in conjunction with synthetic resins (plastics). Where cement moulding is practised, the addition of cellulose-ethers increases the green strength and improves the stripping properties. Moreover, cellulose-ethers are capable of replacing cereals in oil-sand cores. In conclusion it is suggested that they fulfil many of the most important requirements of an ideal corebinder, and will play an increasingly significant part as aids to foundry technique.

Water-soluble cellulose-ethers are widely used in different branches of industry as binders, thickeners, emulsifiers and stabilizers and have in recent years also found a significant new market within the foundry field. The products are applied as core- and moulding-sand binders in conjunction with synthetic resins, core oils and air-setting oils and as an additive to improve the collapsibility of cores and moulds made of clay-bonded sand, cement sand and CO_2-sand.

Water-soluble cellulose-ethers are obtained from high-grade cellulose, preferably dissolving pulp, which is converted to alkali cellulose through mercerizing and treated with suitable etherifying agents. Because the crude product thus obtained contains salts, it must be carefully washed and then, after drying and grinding, the product is ready to be sold in the form of powder, fibres or granules.

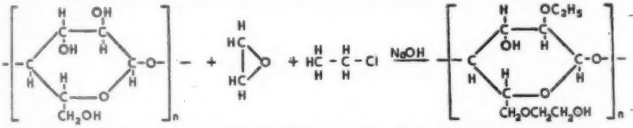

FIG. 1.—*Reaction formula for etherification of cellulose to ethyl-hydroxyethyl cellulose.*

The formula in Fig. 1 illustrates the chemical process in the production of ethyl-hydroxyethyl cellulose, a water-soluble cellulose-ether of Swedish origin, which is widely sold on the world market for various applications. By varying the conditions under which the cellulose-ether is produced it is possible to modify important properties such as, for instance, the viscosity in water solution. Unlike starch, dextrin and other similar products, water-soluble cellulose-ether has no tendency to turn sour, mould or ferment under normal conditions. It has no nutritive value and so has the advantage that destructive insects and animals will not touch it. In contrast to the above-mentioned cereal products, the properties of which vary from one harvest to the other, celulose derivatives can be produced in qualities which remain constant.

Water-soluble cellulose-ethers were first produced on a commercial scale in Germany in the 1930s. The product manufactured at that time was methyl cellulose and later this was followed by sodium carboxymethyl cellulose. Amongst other important soluble cellulose-ether products now on the market should be mentioned: ethyl-hydroxyethyl cellulose, methyl-hydroxyethyl cellulose and hydroxyethyl cellulose.

The first time a soluble cellulose-ether was used as a binder in foundry work was probably in Germany during the second world war, when methyl cellulose and sodium carboxymethyl cellulose were used as "unit" binders in core sand because of the shortage of raw materials for conventional binders. Cellulose-ethers, however, were already at that time being used and are still used, as additives in cement sand. After the war, when cereal and oil binders could again be obtained, cellulose-ethers no longer aroused much interest in the foundries, the main reason for this being that cellulose-ethers have the following disadvantages when used as foundry binders without suitable strengtheners:

1. A large proportion of water must be added to the sand.
2. The cores have a low dry strength and brittle edges.
3. In medium and heavy castings those parts of the core which are located opposite to the ingates are easily destroyed by metal erosion. This is caused partly by the lack of strength of the core and partly because the decomposition of the binder is too rapid.

To this should be added that before 1951 cellulose-ether binders had to be dissolved in water to produce a thick paste, which was mixed into the sand. The fibrous form in which cellulose-ethers were then produced made it impossible to temper the binder directly in the sand. Moreover, the paste could not be used at once but had to be allowed to swell for a few hours before use.

Combination with Synthetic or Natural Resins

In 1951 experiments were started in Sweden to investigate the possibilities of strengthening soluble cellulose-ether, primarily ethyl-hydroxyethyl cellulose, by combining it with other products such as synthetic resins in powder form. The aim was to find the most suitable additives which at the same

* Extracted from *Gjuteriet*.

Water-soluble Cellulose-ethers

time were as cheap as possible to obtain the desired bonding-properties when mixed with cellulose-ethers. By utilizing all practicable combinations existing to-day, it is possible to retain the attractive characteristic of a sand bonded with cellulose-ethers—high green-strength and toughness, good plasticity, low gas content and excellent collapsibility—and at the same time improve the dry-strength control and the collapsibility to suit the actual needs. Amongst the many products which have been tried to improve the strength, melamine and urea-formaldehyde resin have proved especially suitable, but other synthetic resins have also given the desired effect as well as rosin and many other substances. By selecting the most appropriate additives and trying out the best proportions it has been possible to arrive at certain standard products which are particularly suitable as

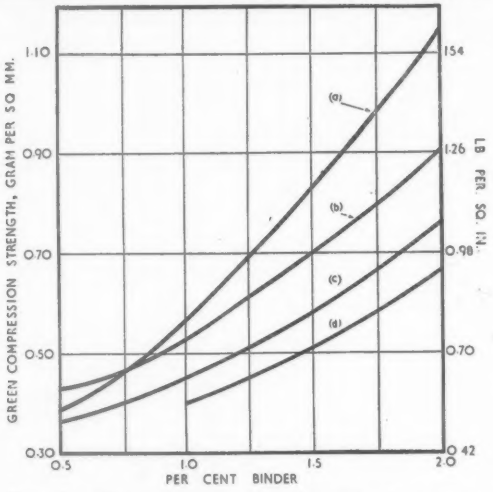

FIG. 2.—*Green compression strength shown as a function of the amount of binder at the following moisture contents:—(a) three per cent., (b) four per cent., (c) five per cent. and (d) six per cent. The binder utilized is a commercial compound of ethyl-hydroxyethyl cellulose and melamine. Baking time* 1½ *hours at* 160 *deg. C.*

unit-core binders. The quantity normally added to the sand is about 0.8 to 1.5 per cent. at a moisture content of about 4 to 5 per cent.

The baked transverse strength of sand bonded with ethyl-hydroxyethyl cellulose alone only reaches a maximum of about 180-200 lb. per sq. in. (130-140 gram. per sq. mm.). With a 1 per cent. addition the figure does not even reach 180 lb. per sq. in. (130 gram. per sq. mm.). By combining ethyl-hydroxyethyl cellulose with melamine a maximum of about 550 lb. per sq. in. (390 gram. per sq. mm.) is obtained with 1 per cent. binder consisting of about 20 per cent. ethyl-hydroxyethyl cellulose and 80 per cent. melamine. However, for most purposes it is desirable to obtain not only a high dry strength, but at the same time as high a green strength and toughness as possible. Therefore consideration must be given to green compression strength, shatter index as well as dry strength when comparing different proportions between ethyl-hydroxyethyl cellulose and melamine. The ideal combination is 60 to 80 per cent. ethyl-hydroxyethyl cellulose and 20 and 40 per cent. melamine, this having been confirmed in industrial experience.

It has been found desirable and suitable to produce core-binders based on cellulose-ethers and synthetic resins in the form of powder in order to facilitate handling, both in shipping and use. The powder should be such that it can be stored for an unlimited length of time. To use these binders the desired quantity is mixed dry into the sand, the necessary amount of water added and the mix mulled to full strength. The time of mixing is the same as for cereal binders, provided that the cellulose-ether is in the form of a fine, quickly dissolved powder in which the synthetic resin has been evenly

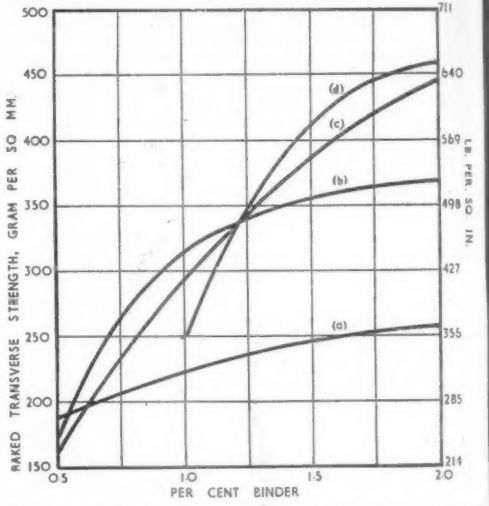

FIG. 3.—*Baked transverse strength as a function of amount of binder at different moisture contents, in this case of* 3, 4, 5 *and* 6 *per cent. as indicated respectively by graph-lines* (*a*), (*b*), (*c*) *and* (*d*). *Baking time* 1½ *hours at* 160 *deg.* C.

distributed. The variation of green and dry strengths as a function of moisture when using a commercial quality of such a "unit" binder is shown in Figs. 2 and 3.

With the practical experience now available it is possible to manufacture combinations of cellulose-ethers and synthetic resin suitable for all kinds of metal castings, such as aluminium alloys, magnesium alloys, copper alloys, tin, lead, grey iron, malleable iron and steel. Cores made with these binders are baked in stoves in the usual way and, since cellulose-ether can with advantage be dried dielectrically,

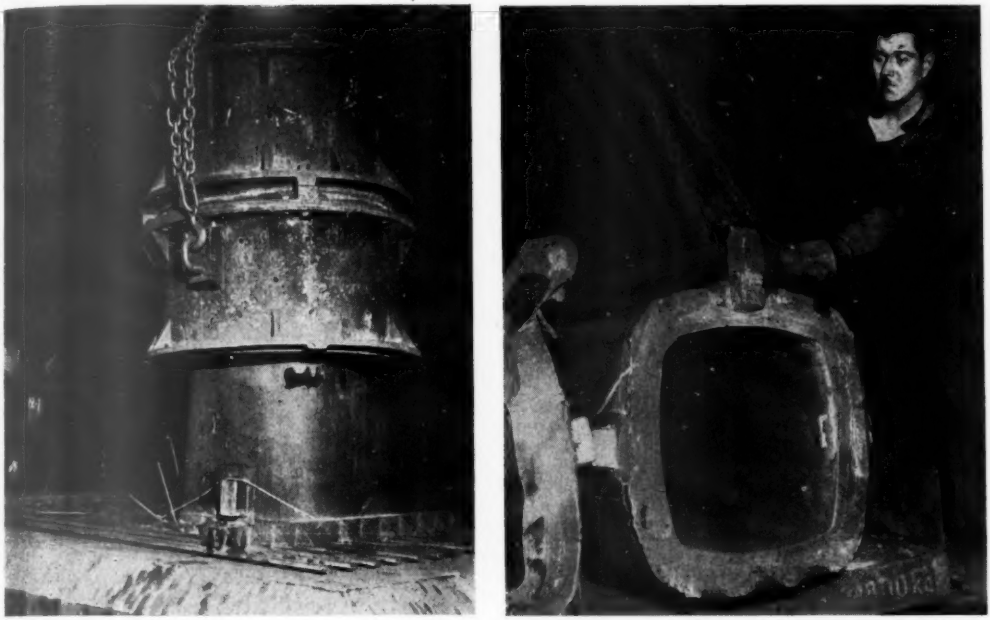

FIG. 4 AND 5.—*The collapsibility of core sand bonded with clay is improved by addition of ethyl-hydroxyethyl cellulose. The core is removed at the same time as the moulding sand at the shake-out. This was not possible to achieve without cellulose-ether.*

cores produced with cellulose-ether combined with synthetic resin may be quickly baked in a high frequency oven with good results.

By addition of a hardener and proper balancing of cellulose-ether and resin it is possible to obtain a sand from which small cores can be made without baking. These cores are air-setting and harden after standing in the air for a few hours.

Gas content

The gas content of core-sand containing a binder based on cellulose-ether and synthetic resin is very low. For example, with 1 per cent. addition of a commercial binder the gas content is only about 13 cub. cm. per gram. of the core sand. A core made with cereal binder and core oil normally has a gas content of 20 to 30 cub. cm. per gram.

Collapsibility

It is usually desirable that the core should collapse completely after the casting has solidified. This is particularly important with light alloys and thin-walled iron castings which are highly susceptible to cracking due to contraction. The same applies also to all castings where the core is more or less completely surrounded by metal, and in all cases where it is difficult to remove the core-sand completely by mechanical means. Cellulose-ethers combined with synthetic resin are in this respect, superior to all other known types of binders.

Water-soluble Cellulose-ethers in Cement Sand

Already at the beginning of the 1940's it was discovered in Germany that water-soluble cellulose-ethers were suitable and practical additives to cement-sand. By such additions the sand attains a desirable green-strength and at the same time the collapsibility is considerably improved. As the cellulose-ether delays the setting of the cement, it is necessary to add an accelerator—for example, calcium chloride—particularly if the hardening takes place without heat, which is normally the case in cement moulding-sand.

It has been shown that combinations of cellulose-ethers and synthetic resin in cement sand give a still better dry strength than cellulose-ethers alone. Addition of calcium chloride results in a rapid hardening which often enables the pattern to be stripped from the mould immediately. Under favourable conditions it is possible to pour the casting only 24 hours after moulding.

Water-soluble Cellulose-ethers in Oil Sand

Certain cellulose-ethers can advantageously replace cereal binders in oil sand. If, for example, ethyl-hydroxyethyl cellulose is substituted for starch, it is necessary to use a quantity corresponding to only 15 to 20 per cent. of the amount of starch usually used to obtain the same green strength and, roughly, the same dry strength. If ethyl-hydroxyethyl cellulose is used in conjunction with

Water-soluble Cellulose-ethers

linseed oil the dry strength is somewhat lower than if starch had been used. This depends partly upon a decrease in the total amount of binder added and it is therefore necessary to increase the quantity of linseed oil. In combination with many other core oils, *e.g.* esterified tall oil, ethyl-hydroxyethyl cellulose often gives a dry strength which is about the same as when cereal binders are used.

It should be mentioned that products based on cellulose-ethers and synthetic resin also can be used in oil sand, and in such case a good surface hardening can be obtained while already in the green state, thus diminishing the risk of dimensional changes during baking.

Sensitivity to moisture

Baked oil-sand cores containing starch binders readily absorb, when stored in damp places, large quantities of moisture. This happens, for example, when cores are left for some time in a green-sand mould before pouring. In this way the cores lose part—and under unfavourable conditions a very large part—of their dry strength besides giving off more gas when surrounded by molten metal.

A simple check on standard transverse cores shows that a linseed oil core with starch, and to still higher degree such a core containing dextrin, is soft and plastic after 24 hours in a green-sand mould. Very little of the original dry strength remains. A linseed oil core with ethyl-hydroxyethyl cellulose added for green strength only absorbs about half the amount of moisture absorbed by a linseed oil core containing starch when submitted to a similar test. Originally both cores had about the same strength. After 24 hours in a green-sand mould a baked transverse test core, made in sand with ethyl-hydroxyethyl cellulose and linseed oil, is hard and has a transverse strength at least twice as high as the starch/linseed oil core after the same time.

Comparison between Different Types of Soluble Cellulose-ethers

It is not only dextrin and starch which have the tendency to absorb moisture to such a high degree that only 10 to 20 per cent. of the original dry strength remains in a standard test core after storing 24 hours in a green-sand mould. Cores made with carboxymethyl cellulose are highly hygroscopic, with methyl cellulose and methyl-hydroxyethyl cellulose they absorb small amounts of moisture but the dry strength is unsatisfactory. Ethyl-hydroxyethyl cellulose and hydroxyethyl cellulose seem to react similarly and are giving the best results in this respect.

However, in view of the fact that 0.4 per cent. hydroxyethyl cellulose only gives a green strength of 0.32 gram. per sq. mm. (0.5 per sq. in.) as compared to 0.59 gram. per sq. mm. (0.8 per sq. in.) for ethyl-hydroxyethyl cellulose, it is obvious that the latter product is to be preferred in this case.

Improvements in Green Strength

Cellulose-ethers generally require a somewhat higher moisture content than starch to give the best green strength and for this reason they have been difficult to use in core sand with a moisture content below 2 per cent. However, new investigations which are not yet finished, show that if, through some suitable additive, the pH-value of the core sand is kept slightly on the alkaline side—for example, pH 7 to 9, it is possible to use ethyl-hydroxyethyl cellulose in the same way as starch even where the moisture content is low, and that, moreover, such an additive increases the green strength and toughness.

Thus, according to the desired properties of the cores, cellulose-ether together with core oil can be used either in its pure form or combined with other substances, such as sodium metasilicate, which is mixed with cellulose-ether in a small quantity so that a suitable pH-value is obtained in the sand.

Tests carried out on the green and baked properties in oil sand with a corebinder that consists of 90 per cent. ethyl-hydroxyethyl cellulose and 10 per cent. sodium metasilicate showed that the green strength and shatter index in oil sand with pH-controlled ethyl-hydroxyethyl cellulose are not only superior to starch but also to other tested water-soluble cellulose-ethers.

Ethyl-hydroxyethyl cellulose and even other cellulose ethers give off smaller quantities of gas than do starch and dextrin. The necessary cellulose-ether addition to oil sand is often considerably smaller than the amount of cereal binder needed to obtain the same green strength. It is for this reason obvious that the gas content must be considerably less.

The amount of gas given off from core sand containing pH-controlled ethyl-hydroxyethyl cellulose and linseed oil has been compared with core material containing starch and linseed oil. The tests showed that the rate at which gas is emitted is relatively slower in the case of ethyl-hydroxyethyl cellulose.

Improvements in Collapsibility

In many cases it is desirable to increase the collapsibility of core- and moulding-sand after pouring. This problem exists in cores made in the CO_2-practice or in clay-bonded cores, for example for ingot moulds. Good collapsibilty is furthermore important in water-jacket cores for combustion engines, in making larger thin-walled parts in light alloy and cast iron and, as mentioned earlier, in cement sand moulding.

In CO_2-practice it is advisable to use pure cellulose-ether, *e.g.* ethyl-hydroxyethyl cellulose up to 1.5 per cent. as an additive in the sand in difficult cases. Some of the dry strength is lost but this can be compensated by the addition of slightly more sodium silicate—in practice it is common to use 4 to 5 per cent. sodium silicate together with 0.2 to 1.5 per cent. ethyl-hydroxyethyl cellulose, calculated on the sand weight.

In clay-bonded cores for ingot moulds 0.1 to 0.3 per cent. pure ethyl-hydroxyethyl cellulose is added. In this way it is easy to remove both mould and core-sand together on the shake-out (Fig. 4 and 5).

Summary

The characteristics for an ideal corebinder have been suggested as:—(1) high collapsibility; (2) low retained strength; (3) ease of shake-out; (4) low gas content; (5) good workability in the corebox; (6) requiring low moisture content; (7) reduced amount of certain ingredients in the core mix; (8) high hot-strength for ferrous and some non-ferrous metals; (9) resistance to metal penetration; (10) producing a protective atmosphere; (11) ease of mixing and thoroughness of distribution in the core sand; and (12) reducing the number of core-sand mixtures in the coreshop.

The results which can be obtained to-day with water-soluble cellulose-ethers combined with various additives seem to be able to satisfy these 12 points. Furthermore by using less binder, working conditions in the foundry are improved, at least as far as troublesome core fumes are concerned. Water-soluble cellulose-ethers have, and will have, a significant part to play as an aid in the foundry technique.

APPENDIX

1. Several of the methods described here are protected by patents or pending patent applications in Sweden and abroad. 2. All core-sand for tests mentioned in this report is based on pure, washed lake sand, Baskarp No. 6 with an average grain size of 0.27 mm. again AFS fineness number 55.* 3. Generally only those tests reported in related tables or diagrams in this report can actually be compared due to small differences brought about by the sand mixer, testing apparatus, and quality of linseed and or other core oil. 4. The apparatus used for determining the gas generated by core-sand mixtures is similar to the one developed by the *Sveriges Mekanförbund*. The gas content is determined volumetrically by heating a 2 gm. sample at 1,000 deg. C. 5. The testing methods for the core-sand are described in "Instructions for testing core and mould sand for foundries," published by *Sveriges Mekanförbund* 1948. 6. The different types of water-soluble cellulose-ethers tested are commercial qualities available on the market.

Acknowledgment

The author is indebted to Mr. S. Bergman for his valuable assistance with several of the laboratory tests.

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published at the same time as the new edition of BS.1400.

Technical Advisory and Research Group. This ABBF activity had now been organized, with a liaison committee to recommend work which should be undertaken by the British Non-Ferrous Metals Research Association. The Group was growing and now numbered 40 members.

At the conclusion of the meeting, those present expressed a desire for more frequent meetings and it was hoped that the next meeting would be held in April, 1958.

ABBF Area Notes

After hearing an explanation from Mr. E. C. Mantle of the British Non-Ferrous Metals Research Association of the information contained in the "Survey of Furnaces for Melting Copper Alloys with Cost Data compiled under Production Conditions in Sand Foundries" and the means by which it was obtained, members at an area meeting of the Association of Bronze and Brass Founders, held at St. Enoch's Hotel, Glasgow, on November 28, 1957, decided to study this survey, compare it with results in their own foundries, and invite Mr. Mantle to attend a further meeting in the New Year to discuss the subject with them.

Earlier, members had a report on Association activities since their last meeting, which included:

The Clean Air Act—The provisions of which were explained. It was stated that an appeal had been made for works in which the melting of copper alloys was carried out, to be exempted from the provisions of the Act and subject instead to the control of the Alkali Inspectorate.

Thermal-insulation Act. This Act required all new buildings after 1958 to conform to a certain standard of heat insulation. A request had been made for melting shops and similar hot workplaces to be exempted, in accordance with section 7 of the Act.

Conditions in Non-ferrous Foundries—Attention was drawn to the first report of H.M. Inspector of Factories' Advisory Committee and members were recommended to acquaint themselves with the recommendations.

Liaison with Associations with Similar Interests—Negotiations by the president of the Association with other bodies were reported.

The European Free Trade Area was briefly reviewed and firms advised to study the effect which it would have on their customers.

European Committee of Foundry Associations. An application had been made by the ABBF to join this body, which is an organization of foundry industries in some ten European countries. The British steelfounders and ironfounders were reported to be already members.

International Foundry Apprentice Competition. This activity of the European Committee was mentioned and the British apprentices who took part in the competition for 1957 were named. It was hoped that members would consider entering apprentices in future years.

*B.S.*1400 *Revision.* Proposals for revision of the existing alloy specifications were reviewed and with the exception of AB.2 were not opposed. Doubts were expressed on the wisdom of increasing the properties demanded of the latter alloy.

"*Companion Volume.*" This was being prepared by the Association's Technical Committee to give guidance in the use of alloys and would be

(Continued at foot of col. 1)

Hardness Measurement at NPL

A machine has been built by the National Physical Laboratory to calibrate hardness test-blocks and so provide a national standard of hardness. The machine is to provide a standard for the Vickers Hardness Scale, but the eventual goal of the research is to provide a standard also for the Rockwell Scale, which is used extensively in industry. When both standards have been achieved, they will remove much of the confusion which exists to-day in hardness measurement throughout the world.

All practical methods of measuring hardness use a diamond or ball which indents the test specimen when pressed into it with a known force. The NPL machine uses a diamond pyramid which can be loaded with 30, 50, 100 or 120 kg. correct to 1 part in 30,000 or better. The width of the indentation produced is then measured to better than ten millionths of an inch using a microscope and a specially designed lighting system. From this, the Diamond Pyramid Number can be calculated. The machine is accurate to $\pm$ 5 DPN units.

The machine is of a completely novel design. Initially the load to be applied rests on a horizontal table with the diamond pyramid, rigidly attached to the load and pointing downwards, just clear of the specimen. The table is lowered hydraulically until the whole load is suspended on the specimen, the diamond pyramid acting as a single-point "knife-edge." The load thus hangs in free air and the force applied to the specimen by the diamond is due entirely to the load. By taking special precautions it is ensured that the diamond pyramid remains vertical within 0.3 second of arc—the angle made by two lines drawn from the top and the bottom of a London suburban house to meet in New York! The hydraulic plunger which operates the table is of a unique design as the table has to be lowered without any jerks at a speed of only 0.001-in. per sec.

As there is no absolute standard of hardness, the accuracy of the machine can only be checked by measuring a specimen which is equally hard all over. Such specimens are extremely difficult to make and the NPL has had to develop new techniques to produce blocks of the required uniformity. The machine will now be tested for long-term stability to ensure that its readings will not change from year to year. A difficulty here is that the only check on the machine is to measure from time to time the hardness of a standard block. It is known that steel, unless specially treated, varies in length as it grows older and it is likely that it also varies in hardness. To separate the possible variations of machine and test block, a number of blocks are being made of different steels and of similar steels differently hardened, since it is expected that if there are any hardness variations they will differ from one specimen to another, while machine errors would be the same for each specimen.

Biggest Rise in Unemployment Since May

Downward trend in demand for labour continues, unemployment having risen by 41,000 to 317,000 (1½ per cent. of the total labour force) between mid-October and mid-November. This is the highest figure since May and compares with 1.3 per cent. in October and 1.2 per cent. a year ago. The number of unfilled vacancies fell from 274,000 to 252,000, the lowest since March.

The demand by manufacturing industry, although increased by 20,000, was not great enough to counteract the seasonal fall in employment.

Future Trade Fairs in Britain

An enquiry just completed by the Federation of British Industries into the future of trade fairs in Britain shows that the vast majority of trade associations are opposed to the development in this country of a general international fair covering a wide range of industrial products, similar to those held in most European countries. They favour, instead, the continued development of specialized fairs, *i.e.*, fairs covering the products of a particular industry. Some 60 such specialized fairs are already held in this country every year, *e.g.*, the Farnborough Air Display, the International Motor Show, the Radio Show, etc.

Of 109 trade associations whose members are concerned with trade fairs, some 105 favoured specialized fairs and only two showed any decided preference for general fairs. A substantial number indicated that they would like to see the scope of specialized fairs widened sufficiently to allow for the grouping of the products of allied industries. The enquiry also revealed that opinion was about equally divided—among those trade associations which expressed a view—on the question whether specialized trade fairs in Britain should be national (*i.e.*, open only to firms showing products of UK origin) or international. This corresponds with the facts of the present situation; of the 60 specialized fairs held each year in this country about half are national and the other half international.

BIF to End?

The FBI enquiry was made in response to a request from the President of the Board of Trade to let him have the opinions held in British industry about future policy on trade fairs in Britain. This arose because the London branch of the British Industries Fair had ceased to operate and the Birmingham Chamber of Commerce had announced that there would be no Birmingham BIF next year and that it would no longer be responsible for such a fair on the existing all-British basis. It asked the Government to go into the question of organizing an international fair. The results of the FBI enquiry have been communicated to the President of the Board of Trade and to the Birmingham Chamber of Commerce.

Now that it is known that industry does not want a large general fair (which would require the provision of around 1,000,000 sq. ft. or more of exhibiting space if it were to compare with the great international fairs of Europe), it is possible to consider what is required in order to give specialized fairs the modern and up-to-date exhibition facilities which they need. The FBI now proposes to institute a further enquiry into this aspect of the problem.

Smethwick Company's Rating Appeal Succeeds

An appeal against a net annual rating assessment of £10,750 on works and premises of the Incandescent Heat Company, Limited, at Cornwall Road, Smethwick, was heard recently by the Stafford South Local Valuation Panel.

Mr. H. G. Bourne, for the appellants, asked for the assessment to be reduced to £8,750, and mentioned that the main ground of appeal was that, except for offices, laboratory, and canteens, the buildings were of a temporary character.

The panel reduced the net annual value assessment to £10,250.

THE CAST-IRON LINING for the new Clyde tunnel is to be supplied by the Stanton Ironworks Company, Limited, near Nottingham.

Lag Construction of Coreboxes

By "Checker"

Lag construction of coreboxes is usually confined to larger sizes of cylindrical or curved shape, giving a sound construction which will withstand normal coreshop handling.

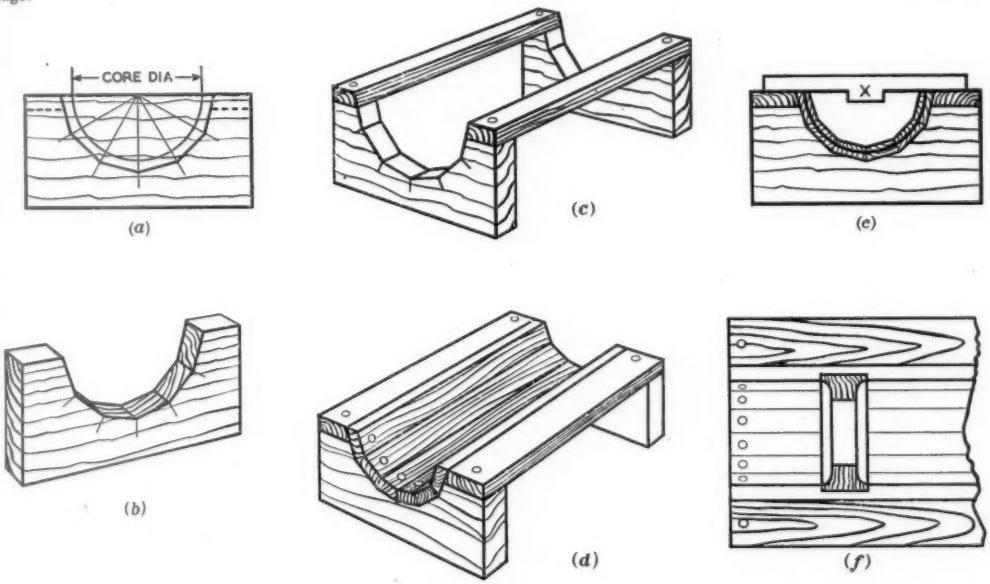
The fabrication is composed of two end pieces (with intermediate pieces for long spans); top or tie bars, and a number of lags (determined by the internal diameter of the core to be produced). The thickness of the timber used depends upon the size of the construction and the shop practice; generally speaking the lags are of 2 by 1½-in. and the tie bars of 2 by 2-in. timber, whilst the end pieces are of 2-in. wood.

Fig. 1*a* shows a side elevation of one of the end pieces, marked out, this being effected after the number and thickness of the lags is determined. Next, a corresponding depth of wood must be removed from the top of the end pieces, to allow for the thickness of the tie bars, as shown in Fig. 1*b* (a sketch of the finished end piece). The two end pieces, together with intermediate pieces (if required) are assembled with the tie bars, which are bevelled to coincide with the angle of the top lag, as shown in Fig. 1*c*. The lags then are inserted, glued and screwed into position, and the assembly (Fig. 1*d*) checked for dimensional accuracy.

To facilitate marking the radius, for milling or planing the core shape out of the lags, it is necessary to clamp to the end pieces a small slat of wood (Fig. 1*e*), to act as a centering support. The desired radius is then inscribed on the end face at each end. In most coreshops the boxes are machined to shape in a pattern-milling machine, although if this is not available they can be finished-off by hand planing, with a round-bottom plane—a more laborious and costly operation.

When the lags are to be parallel, for forming straight or practically straight cylindrical cores, the end and intermediate pieces must be identical in shape and dimension, especially on the flats. Many coreboxes are made with lag construction which are of an irregular shape or with varying diameters. No difficulty is encountered in these circumstances, providing the lags are of sufficient thickness to

FIG. 1.—*Sketches of the stages in the production of a lag-constructed corebox for a cylindrical core. (a) End piece marked-out, showing the desired internal radius of the core, together with the faces for the lags, and the wood to be removed (dotted line) to allow for the thickness of the tie bars; (b) completed end piece; (c) first stage in the assembly of the corebox, showing two end pieces secured with the chamfered tie bars; (d) completed corebox, prior to marking-out and milling; (e) end view of the corebox showing the wooden slat used for centering, when marking-out the radius, and (f) plan view of a completed corebox containing an insert, for which a recess had to be machined in the lags.*



Lag Construction of Coreboxes

permit the greater milling or planing, yet still leaving a sufficient thickness for strength and rigidity. There are other occasions when the lags are made parallel and a section is cut away to a depth of about ¼-in., to form a shoulder for locating inserts, as is shown in Fig. 1*f*, a plan view.

When coreboxes have been finished "to size," the final completion may vary according to individual requirements. Some are encased on sides, ends and bottom by a box frame, with ends checked into the sides, the frame being made first and the lagged part fitted and dropped in afterwards. Others are provided with ends and sides screwed on separately, whilst others are left with only extra strengthening tie bars on the bottom, running the full length. Where two half-coreboxes are required and are to be dowelled together, the ends are usually left open, and only the sides and a bottom are added.

The Bell-maker in History

The earliest bells were made by bending metal plates to shape and riveting these together, usually in a sort of rectangular section. Some such bells of the early Celtic Church have been found in Scotland, Wales and Ireland and these were made of thin-iron plates. Such bells were small by modern standards, that of St. Patrick—"the bell of St. Patrick's will"—preserved at Belfast being only 6-in. tall, 5-in. broad and 4-in. wide. It is decorated richly with gold, precious stones and silver filigree-work. Reference in the Annals of Ulster was made to it in A.D. 552.

Bell-founding in "bell-metal" of various compositions is of comparatively recent date and developed at first at the monasteries. Some of these early bell founders were peripatetic and set up their foundry at the place where the bells were to be hung. Place names like "Bell Field," still exist in various parts of the country dating from the establishment of one of these temporary bell-casting foundries. The bell-metal has varied—the usual mixture is four of copper to one of tin. In the reign of Henry III the proportions were two to one and these have varied somewhat in accordance with the supplies available and the tastes of the founder. Small bells were, and still are, made of a mixture of lead and zinc. The full trumpet-mouthed bell did not appear until the 16th century but it is now the accepted shape to allow ease of casting and to give a good "fundamental" or "tonic" note, one an octave above this in pitch or the "nominal," and one an octave below or the "hum-note." There are also somewhere in the sound, thirds and fifths above the fundamental, and the tuning of a bell means an attempt to bring these sounds into unison and also in harmony with the other bells in the "ring." On the Continent, tuning based on the "fundamentals," and in this country on the "nominals," is the usual practice; but few "rings" of bells are all in perfect unison with themselves and in exact harmony with their fellows.

The casting of bells is a process derived from centuries of experience. This is how it was done in the peripatetic foundries before modern transport made possible the centralization of bell-founding into large factories. First the shape and dimensions of the bell were designed on paper and then the "crook," a kind of double compass was made, full size, in wood, its legs being respectively curved to the inner and outer surfaces of the bell. This compass was then pivoted on a vertical stake driven into the bottom of the casting-pit. Around this stake a cupola of brick was built, hollow inside to take a fire and shaped roughly on the outer side to the sizes of the bell. This brick stuffing was daubed with a mixture of soft, fine clay mixed with calves' hair and the "inside" compass leg run around this covering to give the inner shape of the bell. This core was well smeared with grease, then covered with fine clay to form the shape of the real bell, the outside leg of the compass being used to shape the outer surface. Any legends or dates to appear on the bell surface were then placed in wax in the right position on the dummy clay-bell and all smeared with grease. Then over the clay-bell a covering of fine clay and then coarser clay was carefully smeared to form the outer side of the bell mould.

Next the fire was lighted and the clay-bell baked hard, holes at the top and the outer mould allowing steam and wax and grease fumes to escape. When the dummy bell and mould around it were deemed hard enough the outer "cope" or "mantle" was lifted off, the baked clay of the dummy-bell removed, and the "cope" lowered again into position so as to enclose between it and the core the exact shape of the bell. Into this the bell-founder ran his molten metal. Has bell-founding to-day changed much from this?

House Organs

Newsletter, Vol. 9, No. 11; issued by the David Brown group of companies.

An illustrated story is recorded about a cast-steel spur-wheel, 25-ft. 10-in. dia. for an Aerofall mill to be installed in a copper mine in Southern Rhodesia. In reporting a presentation to Mr. Hubert Wood on his retirement from the position of foreman pattern-maker, it is stated that the original David Brown set up a business as a master patternmaker.

Staveley News, Vol. 6, No. 4; issued by the Staveley Iron and Chemical Company, Limited, and the Sheepbridge Company, Limited, near Chesterfield.

This number describes the opening of a new plant for the manufacture of 10-in. dia. spun pipes. The ceremony was witnessed by a party of Swedish students. In addition to the casting machines, ancillary plant for annealing, cleaning, testing and dipping has been installed.

Stainless Steel Review, Vol. 3, No. 5; issued by the British Electro Metallurgical Company, Wincobank, Sheffield.

This issue is devoted to stainless steel as a medium for the artist, some of whom have made effective use of it, but others have just been wasting their time. The placing of the examples illustrated into these two categories will depend upon the artistic appreciation of the observer, and perhaps his imagination.

Death Duty Problems

Proposal that voting rights should attach to new "A" shares only if the company should fail to pay at least 20 per cent., is put forward by Mr. R. Ross Seymour, chairman of G. Brady & Company, Limited, engineers, brassfounders, etc., of Manchester. Treasury consent has been obtained for a scrip issue and a meeting has been called for December 27 to create 1,400,000 5s. shares, to approve the issue of 600,000 as "A" ordinary on a one-for-one basis to holders at December 6, and to amend the Articles according to the proposal.

Giving the reason for the proposal, Mr. Ross Seymour points out that the company was made public to enable him and his family (who control between them some 40 per cent. of the equity) to make some provision for death duties. It had now become necessary to make further provision for increased death duties that would be leviable consequent upon the rise in the market value of the shares.

"It seems unrealistic that we should strive as we have done, and are still doing, to improve the prospects and profitability of the company if our very success in these directions causes our voting power to be diminished through the necessity of having to provide for higher death duties arising from the enhanced value of the family's shareholdings.

"Nevertheless, we recognize that, if the growth of the company continues, a point may be reached at which it would be impossible, and indeed wrong, for any one family to attempt to continue to control it." That point, he maintains, has not yet been reached.

Colvilles' Record Year

Impressive expansion in steel output, in earnings, and in dividend for the year ended September 30, 1957, is reported by Colvilles, Limited. Steel output rose from 1,973,568 tons to 2,095,274 tons, pig-iron from 741,764 tons to 789,377 tons, and coke from 697,044 tons to 753,921 tons. Although the new Ravenscraig works began to produce steel ingots in September, little contribution could have been made to the year's steelmaking which, however, was a record in the company's history.

Group net profits are up from £2,832,263 to £3,360,403 and the ordinary dividend is increased to 13 (11) per cent. The final is unchanged at 8 per cent., the interim having been raised to 5 (3) per cent. to enable the distribution to be spread more evenly over the year.

After £8,500,368 (£5,927,660) for depreciation, tax, and capital reserve appropriation, etc., the group's net balance of £3,221,883 compares with £2,879,879. Depreciation at £2,092,102 is more than £1,000,000 above the 1955-56 level and includes a full year's provision for the plant included in the first development plan. Additional depreciation of £750,075 covers certain expenditure not represented by productive assets.

WICKMAN, LIMITED, announce that a programme of tests on cemented-oxide tools application is to be undertaken by them. The company has recently installed a machine-tool unit for this purpose, at its Upper York Street, Coventry, works. The unit comprises three machines: a Max Müller eltromatic lathe of special design, a Heller FH.160 milling machine, and a Carlstedt deep-hole boring machine. The new department will be under the control of Mr. R. N. Cook.

American Letter

Renault in US

Sales of Renault cars in the United States will increase 80 per cent. in 1958—to 55,000 units from 30,000 this year, an executive of the French company predicted recently. The booming American market for small, foreign cars, of 200,000 units this year, will more than double last year's figure.

Renault has moved from 1956 sales of a scant 2,000 vehicles in US to more than ten times that number so far in 1957. In the United States it is second only to Germany's Volkswagen. With a substantial boost in output during 1958, Renault will be able to increase exports to the United States by 80 per cent. to 55,000 vehicles, it is claimed. The French firm has formed a shipping company which has already chartered six ships to transport cars to the United States and other countries.

US registrations of the Volkswagen were at 46,209 units for the first nine months of 1957, against 15,645 for Renault, which was not even in the running last year.

Overseas Shipping

Sailings from the Great Lakes to overseas ports will total 354 this year compared with 305 in 1956, a survey shows. The shipping season closes as ice prevents further sailings, but schedules are now definite enough to give the following breakdown of total sailings: To the United Kingdom, 73 this year against 44 in 1956; to continental Europe, 130 against 128; to Scandinavian and Baltic ports, 65 against 66 last year; to the Mediterranean, 53 against 46; to the Caribbean, 10 against 8, and tramp vessels, 23 against 13.

Aid for Mineral Exploration

Government financial aid for approved mineral exploration projects has been reduced in the United States from 75 to 50 per cent. of the estimated total cost for asbestos, columbium, corundum, diamonds (industrial), kyanite, platinum group metals, tantalum, thorium, tin, tungsten and uranium. Other commodities eligible for 50 per cent. government aid are bauxite, cadmium, chromium, copper, fluorspar, graphite (crucible flake), lead, molybdenum and zinc. Left eligible in the 75 per cent. list are antimony, beryl, cobalt, manganese.

World's Largest Crane?

Largest crane in the world is to be built by the Renfrew engineers and boilermakers, Babcock & Wilcox, Limited, for the Hinckley Point atomic power station. It is still at the drawing-board stage, but construction is likely to begin in January. The world's biggest crane at present is a French one and it is being brought to this country for use at the building of the Hunterston atomic power station. Two slightly smaller German cranes have been in use recently in Glasgow.

The revision of plans for Canada's first atomic power station has resulted in the company being left with the parts of an atomic reactor on its hands. The Renfrew works turned out a reactor for the Chalk River Station, but it will now have a reactor of Canadian design which can be built in Canada. A cancellation fee was given, but Mr. C. H. Davy, works director, said the firm had suffered "a great disappointment" over the reactor which was described as "an advanced piece of engineering." The unwanted materials would be put to satisfactory use, some of them being used for other overseas nuclear projects.

Book Reviews

Solidification of Castings (second revised and greatly enlarged edition) by R. W. Ruddle, M.A. Published by the Institute of Metals, 17, Belgrave Square, London, S.W.1; price 42s. (or $6.5).

The production of sound castings is the aim of every foundryman, and the second (revised) edition of this work—the first edition has already proved its worth—will be welcomed by foundry technologists and research workers as constituting a comprehensive and up-to-date theoretical study, in which is detailed the present state of knowledge of solidification phenomena in metal castings, the application of which leads to an understanding of the principles involved in the successful production of sound castings. Compared with the first edition, this is in effect a new book, the length being 406 pages compared with 116 pages; in addition, the scope of the whole work has been amended and extended.

The author first considers the principal experimental methods employed in the study of solidification phenomena in castings, and this leads to a discussion of their qualitative and quantitative aspects. Then follows a survey of experimental work on the flow of heat in sand and in chill moulds, and a discussion of the effects of casting shape and size on freezing rates. The problems of heat-flow and the solidification rates encountered in the production of ingots by continuous-casting processes also receives specific attention. The last chapter deals with the application of theoretical considerations to the production of sound castings.

There are two appendices: In the first, a considerable amount of information is assembled referring to the thermal properties of metals and alloys, whilst in the second, certain tabular and other data referring to definite integrals are given. There is a very full list of literature references covering American, Continental (including Russian) and British sources, and subject and name indices; the work is well illustrated. This volume can be recommended without reserve to all those concerned with the production of sound castings.

J. E. Garside

Structure of Steel by Edwin Gregory, Ph.D., and Eric N. Simons. New edition. Published by Odhams Press Limited, 96, Long Acre, London, W.C.2. Price 18s. net.

The "blurb" modestly states that this book gives a simple and as far as possible non-technical explanation of the metallurgical structure of the various steels and steel alloys, and that it is intended especially for students, engineers and buyers of steel rather than metallurgists. The book, however, has been so carefully written and is one that stands up so well to expert examination that it could advantageously be read by graduates in metallurgy, who in these days are only too often so immersed in nuclear physics that they have forgotten, if they ever knew, all about such mundane things as hardness, creep strength, tensile strength and the like.

The first chapter deals with the constitution of iron/carbon alloys, and is followed by a chapter that deals simply but extremely accurately with the iron/carbon equilibrium diagram and with the critical points. Chapters 3 to 7 deal with crystalline forms, impurities of steel, alloy steels, structure and mechanical characteristics and microscopic structure respectively. These are followed by three instructive chapters which cover the principles of testing, mechanical test methods and non-mechanical test methods in that order, and these alone are sufficient to justify the inclusion of the book in a works' library. The three concluding chapters cover heat-treatment processes, corrosion, stainless steels and structural effects of mechanical working respectively. The book concludes with tables of hardness numbers, a glossary of terms, a bibliography and an index.

J. Ferdinand Kayser.

Publications Received

Life and Work of Frederick Winslow Taylor, by L. F. Urwick. Published by Urwick, Orr & Partners, Limited, 29, Hertford Street, London, W.1; price 2s. 6d.

This is a reprint of an address given before the eleventh International Management Congress held in Paris. The background of the Winslow family, but not the Taylor branch, comes in for consideration. The career of the subject of the address is detailed and analysed. If he was not so well known as the originator of scientific management his name would go down in history as the co-inventor with White of the tungsten/chrome high-speed steel. The address makes very interesting reading.

Professional Foundry Engineering. Issued as *Bulletin* No. 10 by the Knight Engineering Establishment, 17, Bahnofstrasse, Zürich, Switzerland.

The issuing company is associated with the well-known American firm of foundry consultants, Lester B. Knight and Associates, Inc. This *Bulletin* states that the firm has undertaken assignments from more than 370 foundries of all types and listed on the back page of the publication are some of the best known names in the field of cast-metals production. This eight-page brochure intemizes all the various phases of activities the firm's services cover, including cost, control and marketing, as well as the usual engineering activities.

Street-lighting Columns. List of Approved Designs. Published by the Council of Industrial Design, 28, Haymarket, London, S.W.1; price 2s. 6d.

The universal use of cast iron for street lights went out with the introduction of hollow-steel and concrete columns, yet the reviewer still prefers the cast variety. In the city of Westminster, there are many beautiful examples still in existence; moreover, they are very attractively maintained. At the moment, they are painted in a pleasing combination of blue and aluminium. In this list, the words "cast iron" only appears twice in 38 pages of listing.

List of Sandwich Courses, approved by the Ministry of Education. Published by Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2; price 1s. 4d. net.

This official list details alphabetically the local education authority and then gives the name of the college, the subjects provided for sandwich students, the duration of the course, awards available and some other details. It is interesting to note that there is not as yet any provision for approved sandwich courses in England and Wales for foundry technology.

Laboratory Furniture in Metal. Griffin & George, Limited, Ealing Road, Alperton, Wembley, Middlesex, have used a four-page leaflet as publicity for the introduction of metal furniture into laboratories. Unquestionably metal furniture is better in keeping with the general appearance of a modern laboratory.

Opportunities for reducing Foundry Costs*

During a discussion meeting, a précis of which appears in what follows, automobile manufacturers in America were informed of recent developments in foundry processes which may help to reduce costs. The meeting which was reported forms a good example of desirable liaison between officials of foundries and the engineers using their castings.

The foundry industry to-day is offered a variety of new processes which allow it to reclaim materials formerly discarded, to reduce the amount of raw materials required, to obtain better finishes and maintain closer tolerances. These new processes include sand reclamation, shell and CO_2 coremaking and moulding and the employment of hot-blast cupolas.

Sand Reclamation

Sand reclamation enables to-day's foundryman to recover economically discarded sand with physical properties that are compatible with normal core- and moulding-sand requirements. The "wet" reclamation method is composed of three essential operations, in addition to preliminary screening and magnetic separation: (*a*) Scrubbing of the sand grains removes additives, washes, and core- and mould-binders; (*b*) classification serves the dual purpose of removing the material loosened by the scrubbers and of classifying the sand by grain distribution, which also takes out the undesirable fines, and finally (*c*), de-watering is accomplished by filtering, followed by conventional drying procedures.

Sand reclaimed in this way possesses definite characteristics that distinguish it from new sand. Grains have a retained clay, ignition loss, and free-iron under 1 per cent.; grain shape is altered from subangular to a more rounded type and this results in greater permeability, as compared with new sand. In the foundry, reclaimed sand is used interchangeably with new sand; one foundry is using 70 per cent. reclaimed sand at a cost approximately 20 per cent. that of new sand, which has resulted in substantial savings.

When using reclaimed sand for cores, strengths are somewhat lower and, in some cases, a slight increase in binder is necessary. Reclaimed sand contains a large amount of gas compared with new sand, but experience has shown that this gas apparently evolves at lower temperatures and at such a rate that it is completely dissipated before a mould cavity is filled and the iron solidified. No difficulty has been experienced with this gas and reclaimed sand is reported to be used almost interchangeably with new sand in the coreroom. The "wetability" of reclaimed sand does not compare with that of new sand and a wetting agent is used in core mixes.

Shell Moulding

Shell moulding offers savings in sand and produces castings with better finishes and closer tolerances. Shell moulds and cores also make possible the casting of intricate parts which are not practicable in "green" sand. The trend in shell moulding is towards the increasing use of coated sands; such sands are reported to result in resin savings and less dust; they may be conveyed pneumatically without segregation, while mechanical mixtures must be handled by screw conveyors and other conventional sand-handling equipment.

It is quoted that the problem of cracking and distortion of shell moulds during solidification of the metal poured into them can be solved by a number of different methods. First, by applying shell bosses to the back of the "drag" shell, which are rubbed or ground even, to provide uniform support from a backing plate. Another method is by instituting controlled cracking—by notching the shells, cracks are controlled and directed into non-critical areas such as runners and risers. Ribbing of a shell to impart rigidity is possible in certain cases. The conventional methods of bolting, gluing and the use of clips may also be used to control shell deflection and distortion. Curing of the shell and the production of a shell of uniform section-thickness are best accomplished by maintaining uniform temperatures across the pattern surface.

When considering patternplate heating, projections or bosses on patterns, which are usually furthest removed from the heat source and present problems in maintaining temperature, may derive advantage from the application of small electrical heating units placed in the affected area. Temperature and curing times should be controlled to produce the correct shell thickness for each job so that cracking and distortion may be reduced.

CO_2-bonded Core and Moulds

CO_2-bonded cores and moulds permit good dimensional accuracy in castings, due to the sand being hardened in contact with the corebox or pattern surface. Additives in common use to assist breakdown of these sands after casting include coal-dust, pitch, and various sugars. Percentages of binders and additives for CO_2 sand mixes are determined by sand grain size and shape. Any bentonite-free sand may be used, although in making moulds where the pattern is drawn before gassing, some foundries prefer ball clays to obtain improved green-strength at a sacrifice to final hardness. Gassing of the cores and moulds is accomplished by inserting probes or employing manifolds. Probes are most effective for large, chunky cores, while manifolds work well with smaller cores or cores of smaller sections. Core of uneven sections may be gassed by using a manifold after running a vent rod into the thicker sections. This allows the gas to

* Abstracted from the (American) Society of Automotive Engineers' (SAE) *Journal*.

Reducing Foundry Costs

reach the thicker sections quickly and provides even gassing. Each type of core, however, presents a special problem and requires experiments to work out the most efficient gassing procedure.

Advantages and Disadvantages

Finish on castings produced by CO_2 practice is reported good so long as the core is not over-gassed, which treatment results in friable edges. Finish is also impaired when the core is scuffed in handling and the surface skin disturbed. CO_2 cores possess little tensile strength, and if testing is carried out to evaluate binders, compression tests can best be employed. Advantages of the CO_2 practice include immediate use of cores, as gassing time is usually less than a minute. No driers or core ovens are required and there is possible elimination or reduction in rods and wires, still accompanied by production of cores free from distortion or sagging. Less-skilled labour can be used for CO_2 practice, due to its simplicity and the initial cost of equipment is negligible. With CO_2 practice scrap from "blows" can be forgotten in most cases, due to the absence of gas in cores and moulds, thus eliminating venting in many cases.

Disadvantages of the practice include low bench-life of sand mixes, collapsibility problems with grey iron, and difficulty in obtaining fine detail in the castings unless coremaking equipment is perfect.

Hot-blast Cupolas

Hot-blast cupolas present the opportunity for foundries greatly to reduce melting costs. There are two different types of equipment used for blast heating, the externally-fired type and the recuperative type and both have been well developed to make such savings possible.

The externally-fired type of blast-heater heats the incoming air to wind-box temperatures ranging from 200 to 400 deg. C. This type of preheating requires fuel to fire the heat-exchanger at costs varying from 14 to 20 cents per ton of metal charged. The advantage of the externally-fired type of heating is that the initial equipment and installation is usually not as expensive as the recuperator type.

The recuperator type of hot-blast cupola installation captures some of the wasted heat energy that normally is allowed to escape out of the top of the stack. The hot exhaust-gases are passed through a heat-exchanger heating the incoming blast air. This is accomplished by capping the cupola and by-passing the exhaust gases through the heat-exchanger in counter flow to the incoming blast air. Temperatures of up to 510 deg. C. have been obtained with this type of system. The desired wind-box temperature varies with the foundry and is dependent upon the type of iron being produced, the chemical specifications and pouring temperatures desired, and the amount of iron to be melted. Iron : coke ratios are increased from 8 to 1 using cold-blast to 12 to 1 using the hot-blast system. Other savings that result from the reduction in coke percentage and from the increase in wind-box temperature are a decrease in the oxidation loss of silicon and manganese in the metal. The melting rate can be increased as a result of less coke usage. This decrease of coke requirements also brings about a decrease in wind-box velocity and back pressure, both very desirable from the operational standpoint.

Ancillaries

A dry-type dust collector used in conjunction with the recuperator-type hot-blast system eliminates fly-ash and other foreign material from the exhaust gases. One system operates as follows: The exhaust gases first pass through the heat-exchanger, giving up some of their heat to the incoming blast air; they are then introduced at high velocity into the small end of a large cone which is enclosed in a circular structure. When the gases and entrained fly-ash reach the lower edge of the cone, the velocity has decreased, allowing the fly-ash to settle out and be collected. The exhaust gases are then allowed to flow up around the outside of the cone and then to be discharged into the atmosphere relatively free of foreign material. This type of collector overcomes the corrosion problems inherent in the water-spray types. The installation of either type of hot-blast system in conjunction with the proper dust-control equipment is reported to be an important factor in the foundry cost picture to-day.

[Serving on the panel which discussed the above developments in foundry practice were Mr. G. H. Johnson (chairman), production superintendent, and Mr. L. Wood (secretary), sand supervisor respectively of the Chevrolet-Tonawanda Foundry, Mr. A. M. Clark, manager, foundry engineering operations, Ford Motor Company, Mr. L. Clark, foundry research supervisor, Armour Research Foundation, Mr. J. Donaldson, Grindle Division, C. O. Bartlett & Snow Company, Mr. C. D. Evans, development engineer of the Central Foundry Division, General Motors Corporation, Mr. W. Parker, coreroom supervisor, Chevrolet-Tonawanda Foundry, and Mr. C. Collins, plant engineer of the Pontiac Foundry Division, General Motors Corporation.]

Recent Wills

BENDELOW, BERNARD, foundry foreman for Robt. Hyde & Sons, Limited, Stoke-on-Trent £2,713

BLOXHAM, HARRY, a director of Silas Hyde, Limited, manufacturers of dust removal plants and enamelling stoves, of Birmingham £63,868

LAVER, C. E., formerly chief clerk in the sales department of Woodhouse & Company, Limited, brass and iron founders, of Doncaster £9,832

KENDALL, J. W., head of the nuclear engineering development department of John Thompson, Limited, Wolverhampton £12,932

HEYWOOD, WILLIAM, founder of William Heywood & Son, Limited, ironfounders, of Royton (Ches) ... £8,690

BRIDGE, J. F., former secretary of Thos. Firth & John Brown, Limited, steelmakers, of Sheffield ... £13,583

BRAYSHAW, S. N., former managing director of Brayshaw Furnaces & Tools, Limited, Manchester £15,875

FROST, ALBERT, chairman and director of Albert Frost & Company, Limited, manufacturers of colliery and ironworks plant, etc., of Sheffield ... £17,504

DAVIDSON, A. B., retired shipbuilder, formerly chairman and managing director of Wm. Simons & Company, Limited, dredging machinery manufacturers, etc., of Renfrew £15,675

New Catalogues

Magnesium-alloy Castings. J. Stone & Company (Charlton) Limited, Woolwich Road, London, S.E.7, have issued a well-tailored 16-page brochure covering Elektron magnesium castings. The illustrations and the accompanying descriptions carry conviction that even the most complex components are being manufactured to exacting specifications. The weight range of this type of work is steadily mounting and castings approaching six cwt. in weight have been made. In cast iron, a component of the same design would weigh over a ton. By and large, two main types of magnesium-alloys are covered, those alloyed with aluminium and those with zirconium. In a pocket on the inside back cover of the brochure, detailed specifications in tabular form are enclosed. This specially-bound brochure is an excellent example of really high-grade foundry publicity matter.

Exothermic Feeding of Castings. To cover the whole range of castings, Foundry Services, Limited, Long Acre, Nechells, Birmingham 7, have deemed it wise to issue five pamphlets. The first is of the general characteristics of Feedex, the trade name under which these exothermic feeding materials are marketed. Then there are separate booklets dealing with the application of the material to copper alloys, aluminium, cast irons and steel. In each case, specific examples are given in the form of diagrammatic illustrations of castings showing the size and position of the feeding heads. The booklets form a very useful contribution to the complicated subject of runners and risers. All carry the serial number of S.I. and it would seem that founders should specify their particular line of business when writing for any one of these booklets.

Foundry Plant. Foundry Mechanisations (Baillot) Limited, Denbigh Road, Bletchley, Bucks, have released a new edition of their catalogue covering three sizes of sand mills, belt and tilting-skip types of mill-loading plant, and other machinery used in connection with sand preparation; mould conveyors and mechanized plants for bath making and for general castings production. Amongst the mould conveyors, there is an illustration and description of a tilting mould conveyor for use with box-less moulds. There are some good clear illustrations of foundries which have been mechanized by this company. This 24-page catalogue has been carried out in black and green with pleasing effect.

Chemicals. Joseph Crosfield & Sons, Limited, Warrington, have submited a specially bound, well-illustrated brochure covering a limited range of chemicals. Amongst these, however, is sodium silicate which the firm produces as "C" and "M" soluble powder. One catalogue statement, which foundrymen will find easy to believe, is that sodium silicate is finding increasing use in the making of foundry moulds by the CO_2 Process. Another speciality covered in the brochure is silica gel which is also used, for drying and other purposes, by the metallurgical industries.

Industrial Stoving Equipment. In catalogue No. O/1 (reprinted), A. E. Griffiths (Smethwick), Limited, Booth Street, Birmingham, 21, illustrate and describe a wide range of gas—and electrically—heated stoving equipment. Many of the plants covered are conveyorized and made automatic by various means. The ovens are extensively employed for stove enamelling and similar duties. This very nicely produced brochure runs to 32 pages and is available to readers on writing to Booth Street.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

782,553 Hills McCanna, Company, 3025 North Western Avenue, Chicago, Illinois, USA.

Production of castings made of aluminium or magnesium or their alloys which have cored passageways. In a mould a borosilicate-glass (Pyrex) core is placed corresponding to the size, shape and location of the passages, and the molten metal is poured in and allowed to solidify. The glass core is then removed from the casting by selective corrosion with a chemical reagent, whereby the passageway produced is clean and smooth surfaced.

782,644 Aluminium Laboratories, Limited, 1800 Sun Life Building, Montreal, 2, Canada.

Production of light-metal castings incorporating metal inserts. The inserts are aluminized by immersion in a bath of molten aluminium before the casing metal is poured around them. In this invention, the aluminized inserts, possibly after prolonged storage, are treated in a bath wherein the superficial aluminium-oxide skin is dissolved and a protective metal coat is deposited on the aluminium, before they are incorporated in castings, again possibly after further storage.

782,646. American Smelting and Refining Company, 120 Broadway, New York, 5, NY, USA.

A mechanism for removing a casting from a mould, by means of a screw embedded in the ingot. Means are also provided for extracting the screw afterwards.

782,778. Arthur Abbey, 111/112, Hatton Garden, London, E.C.1. (A communication from the Electric Steel Foundry Company, 2141 North West 25th Avenue, Portland, 10, Oregon, USA.)

A steel-alloy and method for producing it, which, while being able to withstand shock, abrasion, torsion, pressure and vibration, is light in weight with no loss of strength. It has also high impact toughness, weldability, and machineability.

782,806. Aktiebolaget Akers Styckebruk, Akers Styckebruk, Sweden.

Improvements relating to the centrifugal casting of tubular-metallic bodies in hot, permanent, chill moulds.

783,365. Gebr. Bohler, A.G., Elisabethstrasse, 14, Vienna, 1, Austria.

A process for cooling cast billets in continuous-casting plants.

783,423. Ideal Boilers and Radiators, Limited, Ideal Works, Hull, Yorks.

A method for casting a radiator, or radiator block, of the kind used in central-heating systems.

FBI Register of British Manufacturers, 1958. Third Edition. Published for the Federation of British Industries by Iliffe & Sons, Limited, Dorset House, London, S.E.1; price 42s. post free. This, the third edition, follows the same make-up as last year—that is, it covers 7,000 member-firms' products under 5,400 alphabetical headings. In addition to a buyers' guide, there are sections giving brands, trade names and trade marks; glossaries in French, German and Spanish are also included.

Imports and Exports of Iron and Steel in October

The following tables, based on Board of Trade returns, gives figures of imports and exports of iron and steel in October. Totals for the first ten months of this year and last are also included.

Total Exports of Iron and Steel

Destination.	Month ended Oct. 31.	Ten months ended October 31.	
	1957.	1956.	1957.
	Tons.	Tons.	Tons.
Channel Islands	302	4,104	2,901
Cyprus	433	5,176	9,645
Sierra Leone	1,206	6,958	11,948
Ghana	1,707	19,695	19,480
Nigeria	5,801	45,225	47,659
Union of South Africa	8,071	57,056	91,848
Rhodesia and Nyasaland	4,873	69,131	56,605
Tanganyika	1,150	19,664	19,026
Kenya	3,764	36,687	42,352
Uganda	193	4,036	3,066
Mauritius	79	3,144	2,571
Aden	732	4,574	3,893
Bahrein, Qatar, and Trucial States	2,012	9,266	13,442
Kuwait	3,026	6,895	30,637
India	9,127	250,091	195,175
Pakistan	6,021	45,423	58,236
Singapore	3,578	27,121	32,442
Malaya	1,809	29,164	27,208
Ceylon	1,971	24,947	22,563
British North Borneo	268	4,957	3,338
Hongkong	4,052	57,145	68,284
Australia	17,284	177,656	162,741
New Zealand	19,326	147,437	172,093
Canada	27,771	244,405	242,873
Jamaica	2,161	18,319	19,419
Trinidad	4,962	35,363	41,133
British Guiana	850	4,485	6,386
Other Commonwealth countries	2,203	23,883	23,745
Eire	5,291	55,186	36,932
Finland	5,914	48,886	70,294
Sweden	10,000	92,649	90,941
Norway	5,847	73,422	86,780
Denmark	6,201	63,778	87,239
Western Germany	1,461	7,719	8,526
Netherlands	4,844	73,917	81,467
Belgium	3,933	26,644	38,956
France	1,187	9,243	14,545
Switzerland	1,374	11,343	14,381
Portugal	930	8,476	14,990
Spain	2,634	24,695	33,328
Italy	3,261	14,284	42,845
Austria	505	3,765	4,501
Yugoslavia	992	6,390	9,514
Greece	869	4,727	9,527
Turkey	2,048	3,629	7,341
Netherlands Antilles	236	6,809	2,805
Portuguese East Africa	96	2,464	3,712
Egypt	2,379	34,905	5,121
Sudan	1,411	11,241	16,247
Lebanon	2,978	5,101	13,058
Israel	612	6,635	3,963
Saudi Arabia	874	14,349	4,026
Iraq	2,821	24,961	33,615
Iran	2,735	54,158	49,959
Burma	962	7,040	21,572
Thailand	583	6,405	6,743
Indonesia	408	8,680	6,024
Philippine Republic	1,265	6,430	5,818
USA	4,534	52,073	43,130
Cuba	1,127	7,493	7,517
Colombia	1,529	4,121	6,658
Venezuela	8,526	55,749	97,385
Ecuador	496	3,562	2,512
Peru	1,355	14,110	10,815
Uruguay	636	4,642	6,273
Argentina	22,168	43,246	87,799
Other foreign countries	12,120	57,233	117,802
TOTAL	262,024	2,342,147	2,636,365

Total Imports of Iron and Steel

From	Month ended Oct. 31.	Ten months ended October 31.	
	1957.	1956.	1957.
	Tons.	Tons.	Tons.
Rhodesia and Nyasaland	1,126	2,957	4,960
Canada	3,550	52,610	37,692
Other Commonwealth countries and Eire	1,831	6,616	19,994
Soviet Union	19,036	238,108	221,888
Sweden	2,840	41,621	27,456
Norway	11,860	91,418	98,692
Western Germany	9,169	185,933	86,496
Netherlands	10,388	86,850	56,767
Belgium	11,715	221,522	129,608
Luxembourg	2,254	51,726	22,101
France	7,828	196,852	57,385
Italy	249	11,943	3,576
Austria	344	136,720	59,061
Japan	2,616	15,367	13,363
USA	26,908	369,409	236,935
Other foreign countries	982	63,578	26,373
TOTAL	112,696	1,872,730	1,102,347
Iron and steel scrap and waste, fit only for the recovery of metal	33,114	873,098	600,902

Exports of Iron and Steel by Products

Product.	Month ended Oct. 31.	Ten months ended October 31.	
	1957.	1956.	1957.
	Tons.	Tons.	Tons.
Pig-iron	9,653	105,067	106,462
Ferro-columbium (niobium)	3	128	80
Ferro-tungsten	74	940	482
Other ferro-alloys	220	3,619	2,711
Ingots, blooms, billets, slabs, sheets, and tinplate bars	73	1,664	966
Iron bars, rods, angles, shapes, and sections	208	1,720	1,543
Steel bars, rods, angles, sections, and shapes	28,595	379,834	422,560
Iron plates and sheets	6	444	408
Universal plates	160	3,165	5,309
Steel plates, ⅛ in. and under ¼ in.	1,155	8,279	10,124
Do., ¼ in. and over	12,241	190,089	152,352
Blacksheets and blackplate	33,963	188,685	286,797
Hoop and strip	7,102	73,084	75,285
Tinplate	45,283	249,292	347,546
Decorated tinplate	376	4,895	4,286
Galvanized sheets	9,702	130,230	161,233
Other (including tinned sheets, terneplate, and ternesheets)	1,632	12,403	15,889
Railway and tramway construction material	24,619	222,085	222,156
Wire rods	4,630	33,371	48,124
Wire	8,949	79,657	90,125
Tubes, pipes, and fittings	72,500	646,121	671,060
Iron castings	110	2,085	1,599
Steel castings	225	1,619	2,364
Forgings	545	3,661	6,904
TOTAL	262,024	2,342,147	2,636,365

ALEX STEPHEN & SONS, LIMITED, Glasgow shipbuilders, have secured an order to build a cargo ship for T. & J. Brocklebank, Limited, Liverpool, for delivery late in 1962. The value of the vessel is said to be in the region of £1,000,000.

ADDITIONAL PLANT AND EQUIPMENT is being installed in the works of the Peterborough Die Casting and Machine Company, Limited, and plans are under consideration for further expansion. The business recently celebrated its 21st anniversary, having started in 1926 in a small garden shed in Peterborough.

News in Brief

THE Australian Trade Minister, Mr. J. McEwen, announced recently that the export of iron and steel scrap, under quota, to 80,000 tons would be allowed in 1958.

THE FOLLOWING DERBY FIRMS closed on December 24 and reopen on December 30: Rolls-Royce, Limited; Leys Malleable Castings Company, Limited; International Combustion, Limited; Aiton and Company, Limited; and Qualcast, Limited.

THE 35,000-TON BATTLESHIP, H.M.S. Howe, is to be broken up on the Firth of Forth. The vessel was built at the Glasgow yard of the Fairfield Shipbuilding & Engineering Company, Limited, and completed in 1942. The Howe will be towed to Inverkeithing for demolition by Thos. W. Ward, Limited.

SHEFFIELD TOOL FIRMS of James Neill and Company (Sheffield), Limited, and C. and J. Hampton, Limited, were visited by Mr. E. B. Stocker, president of the Canadian Importers' and Traders' Association, Montreal, and a member of the Canadian Mission to this country, on December 12.

WITH THE OBJECT of exploiting and turning to account any interests in any part of the world, Averys, Limited, has been registered as a private company with a nominal capital of £100 in £1 shares. Two other companies with the names Avery Scales and Avery Testing Machines have also been registered.

THE BRITISH INSTITUTE OF MANAGEMENT, 80, Fetter Lane, London, E.C.4, have issued a programme of the conferences and lecture courses to be held under its auspices during the first six months of next year. Details are obtainable from the programme development department of the Institute at the address quoted.

A MEETING of the North and East Lancs section of the Institute of British Foundrymen was held on December 18 at the College of Further Education, Sandy Lane, Accrington. The speakers were Mr. E. H. Beech and Mr. N. Bradshaw, and the subject of their lecture was "Co-operation between Patternshop and Foundry."

A SPOKESMAN at High Duty Alloys, Limited, Redditch, confirmed on December 13 that there would be redundancy at the factory in the New Year. He said that discussions had taken place with shop stewards but the actual numbers to be laid off and the time had not been decided. The redundancy is believed to be due to cuts in the defence programme.

ROBERT TAYLOR & COMPANY (IRONFOUNDERS), LIMITED, Muirhall Foundry, Larbert, held an exhibition last month at the Kent Hall of St. Andrew's Hall, Glasgow. A full range of castings in grey, spheroidal-graphite and special alloy iron were shown. (A detailed account of this foundry was given when publicizing Scottish works visits in the JOURNAL of September 26, 1957.)

AS PART of the British Railways modernization plan, the British Transport Commission has ordered 42 sets of engine transmission and control equipments for 0-6-0 diesel mechanical shunting locomotives of 200 h.p., from the Drewry Car Company, Limited, London, E.C.2. The completed locomotives will be allocated between the North-Eastern and Southern Regions.

SIR DAVID ECCLES, President of the Board of Trade, will leave London on December 28 for a visit to Venezuela and Mexico. He will travel by the polar route in order to spend a short time in Vancouver and San Francisco. Sir David expects to spend about a fortnight in Mexico and Venezuela, which, the Board of Trade states, "are dollar markets of growing importance."

EIGHTY EMPLOYEES of Sheepbridge Alloy Castings, Limited, of Sutton-in-Ashfield, who have been engaged on aircraft-engine production, have been given three weeks' notice. For some time this section has been working a four-day week. The notices will be effective from December 27, and it is understood that a number of the men concerned may be absorbed by a subsidiary. Men in other parts of the works are not affected.

CONTRACT FOR SUPPLY of the main circulating and auxiliary water valves for the new Staythorpe "B" power station has been awarded by the Central Electricity Authority to Sir W. H. Bailey & Company, Limited, of Patricroft, Manchester. Amounting to £86,000, the contract comprises a total of 97 valves, in diameters of up to 54 in. Twenty-eight of the valves will be electrically-operated and the remainder motor-driven. The consultant engineers for the project are Balfour Beatty and Company, Limited, of London.

THE SHEFFIELD BRANCH of the British Institute of Management were told the case for closer co-operation and greater exchange of information, not only among managers, but among workmen, trade unionists, and works councillors, when Canon E. R. Wickham, Sheffield Diocesan Industrial Missioner addressed them at the Grand Hotel, Sheffield, on December 2. He said is was one of the things that struck him on his recent visit to America. He believed there would be enormous gain from exchange of personnel, and not just at the level of management, research and sales, which tended to be the case now. He said many Sheffield businessmen were accustomed to visit America, and he wished as many Americans came here.

LORD DUDLEY GORDON, chairman of Hadfields, Limited, Sheffield, presented prizes won in ambulance competitions at the 49th annual dinner of the firm's ambulance society in the canteen of the East Hecla Works, Vulcan Road, Sheffield, recently. He said that as president of the society he was very gratified that a number of apprentices were members. Mr. G. E. Scott, Sheffield chief constable, stressed the great need of ambulance work, especially because of increasing risks, as the accident at the Windscale atomic plant indicated. Other speakers were Mr. R. Lamb, a local director of the firm and chairman of the society; Dr. James Gregory, the firm's medical officer; and Mr. J. Young, the firm's night manager.

LEEDS ASSOCIATION OF ENGINEERS held their 92nd anniversary dinner at the Great Northern Hotel, Leeds, early this month, when there was an attendance of nearly 250. Mr. G. Ronald Pryce, chairman, commented that many aspects of industry called for re-examination. He said of piecework that much of what was claimed for it was suspect as so many imponderables were not taken into account. Piecework put a high premium on mere manual dexterity and ignored other aspects of workmanship. Mr. C. W. Mustill, president, said that the Association was proposing to help restore the obelisk in Holbeck churchyard which was a memorial to Matthew Henry. The present state of the memorial was no credit to an engineering city like Leeds. He added that the Association now had a membership of nearly 500 and the average attendance at its meeting was almost a national record. Other speakers included Mr. T. G. C. Woodford, headmaster of Leeds Grammar School, Mr. G. A. Aldred, vice-president, and Mr. Edwin Watkinson, chairman of the Yorkshire branch of the Institution of Mechanical Engineers.

Company Meeting

HALE & HALE (TIPTON)

(Producers of Fine Blackheart Malleable Iron)

Efforts to Combat Rising Costs

Mr. W. Edgar Hale on Programme of Modernization

The 21st annual general meeting of Hale & Hale (Tipton), Limited, was held on December 18 at Dudley, Mr. R. C. Leppington (vice-chairman and managing director) presiding in the unavoidable absence of the chairman, Mr. W. Edgar Hale, M.I.MECH.E.

The following is an extract from the chairman's circulated statement:

The profit and loss account of the holding company shows a trading profit of £82,884, as compared with £100,300 for the previous year. Taxation takes £25,162 and after various adjustments there remains a net profit for the year of £25,067. Your directors propose a final dividend of 17½ per cent., less tax, making 25 per cent., less tax, for the year.

The consolidated trading profit for the year amounts to £101,287, which figure compares with £118,960 for the previous year and shows a decrease of £17,673.

Taxation requires £29,905, and, after adjusting for excess provisions in respect of earlier years of £8,256, there remains a consolidated net profit of £31,919, which shows a decrease of £6,156 on last year's comparable figure.

Production and Sales

This has been a somewhat difficult year from the trading point of view, due in the early stages to the fall-off in the car industry, followed by the Suez crisis, which also appreciably affected the light and heavy commercial vehicle industry, agricultural machinery makers, and many other trades with which we are associated.

In conjunction with these trading setbacks we have been faced with substantial increases in raw materials, fuel, and freights from the nationalized industries, together with increased wage costs.

Our programme of modernization and improvement, however, still goes forward, as this is obviously the only way we can seriously combat rising prices and maintain our own costs at a reasonable level, also our new melting installation is now going into production, and this we hope will be the forerunner of others which will ultimately show a saving on melting costs.

The next section of our foundry mechanization scheme should be operating within a few months, which will further increase our productive potential. With a view to improving quality standards, a new finishing department has been installed and is equipped with modern power presses.

Production is now getting back to normal level and should steadily increase, provided there are no further "setbacks" waiting round the corner.

Subsidiaries

CHATWINS, LIMITED—The year has been incomparably the most difficult one experienced in recent times both as regards solid-fuel appliances and oil heaters, due amongst other things to the abnormally mild weather last winter which sharply reduced the seasonal demand, the unsettling effects of the "Clean Air Bill," causing a reduction in the demand of solid-fuel appliances, and drastic price-cutting throughout the industry, often made without logical regard to actual costs. Despite these adverse conditions, we were able to obtain a large proportion of the available market in solid fuel goods.

As regards the solid fuel side, we have a favourable order-book, although the oil heater position has not yet got underway, this position being common to our competitors. For the future, we can be reasonably optimistic, particularly when I mention that after much time and effort we are going into production of a new solid-fuel stove, the world manufacturing rights of which we secured in face of large competition. Briefly, the stove virtually consumes its own smoke, the smoke reduction vastly exceeding that of any other coal-burning appliance. Recommended fuel is small coal in keeping with the national requirements, and the use of the stove would actually halve domestic coal consumption, whilst working at double the efficiency of any similar contemporary heating appliance. Altogether, this is a very worthy addition to the "Sunbeam" range of products.

J. & J. WHITEHOUSE (TIPTON), LIMITED—This subsidiary produces cast-iron holloware for export, under the name "Phœnix," but its success depends entirely upon obtaining the right type of labour, which is very difficult today. However, the year's trading compares very favourably with the previous year, whilst the order-book is quite healthy.

HALE ENAMELLERS, LIMITED—This subsidiary produces vitreous enamelling of first-class quality, and for the first six months of the trading year, the results were satisfactory and adequate work was being processed. Due, however, to the recession in the solid-fuel industry, the output was somewhat reduced, but at present full production is being maintained.

J. WAKEFIELD & SONS, LIMITED—We acquired this small company in December last. This subsidiary is an old-established business manufacturing oil lamps for heating and lighting, and should later prove beneficial to Chatwins, Limited, in their manufacture.

Current Outlook

As to future prospects, I do not think there has been a more difficult period for many years now in which to prophesy what the future holds in store for industry as a whole, and more particularly for those sections of industry which are engaged in iron and steel. The time has arrived in the ingot steel industry when there is comparatively little backlog on order-books to be pulled up. In fact, one must incline to the view that production is already exceeding demand, and this prospect directs one's mind to the extremely important part that increased exports will play in this connection. Only a Jules Verne could have predicted 30 years ago that in our time there would have been made roughly half a million tons of ingot steel each week—a marvellous performance, of which the steel trade can be justly proud.

I am fairly certain, however, that if the low price at which sterling can be bought in foreign markets, particularly in America, keeps at its present low level, we shall have an immense advantage over our competitors in the world's markets due to the fact that our money is cheap. There is also a new feature which is of vital importance, and that is the present high Bank rate. It is to be hoped that in the not far distant future the Treasury will see its way clear to exercise its influence in reducing the present high rate, which is bad for the country under most circumstances, although at the moment there appears no alternative to enable us to combat the world's money market speculators.

The report was adopted.

Personal

Col. T. F. HOOD has been appointed to the board of Spencer (Melksham), Limited.

Mr. A. H. MONCRIEFFE has been appointed by British Railways North Eastern Region to the post of assistant to commercial officer (sales).

Mr. LEONARD S. DARBY has celebrated 50 years with Raleigh Industries, Limited, by taking up a new position as works manager of the Sturmey-Archer division, on his 64th birthday.

Mr. HUGH S. FERGUSON, former executive vice-president of W. R. Grace and Company, has been elected to the board of directors of the National Research Corporation (of America).

Mr. A. LOMAS, governing director of J. J. Dyson, Limited, Sheffield, presented trophies to members at the annual dinner of the firm's sports and social club at the works canteen, at Stannington, on December 6.

Mr. KENNETH S. FERGUSON has been appointed education and training officer to Hoover, Limited. He will take charge of all training and education in the company's group of factories in Southern England.

Mr. C. A. BELL, until recently manager of George Cohen's machinery division in the Midlands, has been appointed managing director of George Cohen Sons & Company (Australia) Pty. Mr. Bell will take up residence shortly in Sydney.

Mr. G. M. MELLOR has resigned the post of joint managing director of Bennis Combustion, Limited, but will continue as chairman and sales director. Mr. B. W. DAWKINS has been appointed a joint managing director of the company.

The Vice-Chancellor of Cambridge University, Lord Adrian, has announced that Mr. J. A. T. GALVIN, of the Eastern Mining & Metals Company, Limited, has offered to provide £1,500 a year for three years to cover the cost of the work of completing an English-Malay dictionary.

Mr. N. C. LAKE has been appointed a director and deputy managing director of Head, Wrightson and Company, Limited. He will be responsible for the coordination of the group sales to the iron and steel industry. Mr. Lake was formerly managing director of the Head, Wrightson Machine Company, Limited.

Sir PATRICK HAMILTON has been appointed by the President of the Board of Trade to be chairman of the Advisory Committee on Commercial Information Overseas. He succeeds Mr. LAURENCE HEYWORTH, who has resigned through ill-health. Lord DROGHEDA, Sir RAYMOND STREAT and Mr. E. A. BINGEN have been appointed to the Committee and Mr. J. DOUGLAS HOOD has resigned.

Mr. A. S. JOHNSTONE, works manager of Robey & Company, Limited, engineers, Lincoln, is to retire at the end of the year after 29 years' service with the company. He is a former president of the Lincoln Engineering Society, and was chairman of the Nottingham branch of the Institution of Production Engineers for some years before helping to inaugurate the Lincoln section.

Consequent on Mr. J. F. PERRY'S retirement from the board, Mr. F. R. MASON has been appointed managing director of Metropolitan-Vickers Electrical Export Company, Limited; Mr. H. F. BIBBY succeeds Mr. Mason as the export company's general manager. Mr. F. R. Mason has also been appointed to the boards of Metropolitan-Vickers Electrical Company, Limited, and Associated Electrical Industries Overseas, Limited.

Mr. BILL STOCKER, assistant foundry manager of Brightside Engineering Holdings, Limited, Sheffield, who retires this month, was presented with a gold watch at the company's annual dance in Sheffield on Wednesday, December 11, to mark his completion of 50 years' service. Two other employees, Mr. FRANK GRANGE, a foreman moulder, and Mr. MAURICE DEARDEN, of the accounts department, received certificates in recognition of 40 years with the company.

International Alloys, Limited, announce that Mr. H. C. BLENCH, M.C., and Mr. S. SANDERS, having reached retirement age, will relinquish their directorships at the end of this year. Dr. E. SCHEUER, F.I.M., head of the laboratories, and Dr. G. J. THOMAS, B.SC., formerly branch manager of the Birmingham works, have been appointed directors. Dr. Thomas will become works director and Mr. F. G. BACON, B.SC. (ENG.), lately works director, will become commercial director.

A moulder at Ferrous Castings, Limited, Warrington, Mr. HAROLD FOSTER, was recently presented with a clock in recognition of 25 years' service with the company. The presentation was made by Vice-Admiral Sir FRANK MASON, K.C.B., a director of Metal Industries, Limited, of which Ferrous Castings is a subsidiary. Mr. D. Robertson, managing director of Ferrous Castings, in welcoming the guests, said that 18 of those present had an aggregate service with the company of 566 years.

Mr. G. H. GRANGE, who for six years has been managing director of the Shipston Engineering Company, Limited, Shipston-on-Stour (Warwickshire), and its associated companies, is to take up an executive appointment with the C. A. Norgren Company, of Englewood, Colorado. The Shipston companies, with which he has been associated since 1946, manufacture compressed-air equipment under licence from two American concerns, one of which is C. A. Norgren. Mr. Grange was founder-president of the Shipston Chamber of Trade.

Obituary

Mr. AMOS CARTER, who had been employed by Holwell Ironworks, of Stanton, Ironworks Company, Limited, for about 40 years, died recently in Melton War Memorial Hospital. He was 64.

Mr. GEORGE SANDISON, who has died at the age of 71, was foundry manager with John White & Son, Auchtermuchty. He commenced work with the firm 35 years ago, having come to it from Glasgow.

Mr. WILLIAM JAMES BOYLE, director of Lane and Girvan, Limited, ironfounders, Bonnybridge, has died at the age of 79. He had been a director of the firm since 1935 and had been employed by the firm since 1908, when he was appointed works manager after a period of training in a Glasgow foundry. He retired from this post in 1949, but continued as an active director.

Mr. WILLIAM ROBERT DUNCAN, of Milnsbridge, near Huddersfield, has died at the age of 73. In 1909 Mr. Duncan began work as a fitter for David Brown and Sons (Huddersfield), Limited, and later became works superintendent in the heavy engineering department. In 1948, Mr. Duncan was awarded the M.B.E. for "exceptional keenness and a high sense of duty." He went into semi-retirement the following year but continued to act in a consultative capacity until his complete retirement in 1953.

Company News

LONDON ALUMINIUM COMPANY, LIMITED—The interim dividend is ½ per cent. lower at 2 per cent.

QUALCAST, LIMITED—The company's offer to acquire all the ordinary shares of H. Kaufmann, Limited, ironfounders, of London, E.C.4, has been accepted by holders of more than 95 per cent. of such shares.

MIDLAND BRIGHT DRAWN STEEL & ENGINEERING COMPANY, LIMITED—Group trading profits contracted from £356,599 to £238,738 for the year to October 31, 1957. A final dividend of 27½ per cent. makes 45 per cent. (same).

JOHN FOWLER & COMPANY (LEEDS), LIMITED, diesel crawler tractor and diesel locomotive manufacturers—As last year, the company is paying no ordinary dividend for the year ended September 30, 1957. Net profit is £4,198, which compares with a loss of £122,058.

DAVID BRIDGE & COMPANY, LIMITED, engineers and ironfounders, of Rochdale—A rise in profits from £261,399 to £388,007 is reported for the year to September 30, 1957, and the company is increasing its total ordinary dividend by 5 per cent. to 22½ per cent., with a final of 17½ (12½) per cent.

MIDLAND ALUMINIUM, LIMITED—While only five months of the current year have passed, the profits are already in excess of the profits earned by the group in the whole of the year 1956-57, according to the chairman, Major C. R. Dibben. The bank overdraft showed a satisfactory reduction and the outlook for the rest of the year was "most encouraging."

ACROW (ENGINEERS), LIMITED—Following last October's announcement of the inauguration of a quarterly dividend policy, a first payment of 10 per cent. for the year to March 31, 1958, is announced. It is payable on capital increased to £450,000 by an issue of £50,000 in non-voting "A" ordinary shares. For 1956-57 there was a total dividend of 37½ per cent. on £400,000 ordinary.

WOLVERHAMPTON DIE CASTING COMPANY, LIMITED—The company considers that it is essential to continue the policy of introducing the latest machines and methods of production to meet the challenge of the European Common Market. An infusion of new money has been found necessary to finance expansion, and, accordingly, discussions on the best way to raise new capital are taking place. No definite decisions have been made.

JOHN SUMMERS & SONS, LIMITED, steelmakers, etc., of Chester—Against a forecast of not less than 8 per cent., the company is to pay a final ordinary dividend for the year ended September 28 of 10 per cent. on the capital increased by a one-for-two rights issue. An interim of 4 per cent. was paid on the smaller capital. For 1955-56 an interim of 4 per cent. and a final of 8 per cent. were made on the old capital. Group profits rose by £1,726,540 to £11,169,573 after having been £768,744 higher at £9,443,033 in 1955-56.

BRITISH ELECTRIC RESISTANCE COMPANY, LIMITED—In present disturbed conditions it was not felt that any issue satisfactory to the company could be made. The chairman, Mr. Henry Paul-Huhne, said there had been a number of inquiries as to whether the creation of a further 1,000,000 2s. shares meant that the board intended to make an immediate issue. Since the raising of Bank rate conditions had become too unsettled and the board wanted to be in a position to take advantage of any improvement which might occur in market conditions.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

UNION OF SOUTH AFRICA, January 9, 1958—Woodworking machinery. (ESB/29659/57.)

CAVAN, EIRE, February 17, 1958—Supply and erection of two pumping sets, combining centrifugal pumps and electric motors with all necessary accessories for the Gowna water supply for the County Council. Documents from P. H. McCarthy & Son, 25, Lower Leeson Street, Dublin, or M. Harding, acting secretary, Courthouse, Cavan. Deposit £5 5s.

UNION OF SOUTH AFRICA, January 2, 1958—Machine tools, woodworking machinery, handlift trucks. (ESB/29486/57.)

BRAZIL—Luporini Commercio e Industria S.A., Rua do Riachuelo, 206/212, Caixa Postal 2282, Rio de Janeiro, announce that they wish to get into touch with UK manufacturers of equipment for mining and civil engineering construction including—portable and stationary air compressors, pneumatic tools and stationary and marine diesel engines. (ESB/29364/57.)

AUSTRALIA, March 5, 1958—Diesel-electric locomotives. (ESB/29065/57.)

INTERNATIONAL CO-OPERATIVE ADMINISTRATION.—The following future authorizations have been announced: Republic of Korea—Equipment for paper mill including iron and steel mill materials, steel mill products and ferro-alloys to the value of (US)$10,500; generators and motors ($12,975); construction, mining and conveying equipment ($23,660); and industrial equipment, N.E.C. ($452,865). Contract period ends April 30, 1958, and the terminal date is October 31, 1958. Vietnam—Iron and steel mill materials, steel mill products and ferro-alloys (excluding ferrous scrap) to the value of $25,000. Contract period ends January 31, 1958; terminal delivery date, July 31, 1958. (ESB/29193/57/ICA).

FRIMLEY AND CAMBERLEY, SURREY.—Following, for Urban District Council, for the year ended March 31, 1959: Cast-iron goods. Documents from the Engineer and Surveyor, Municipal Buildings, London Road, Camberley. Tenders by February 11.

ILFORD, ESSEX—Supply of the following for 12 months ending March 31, 1959, for Town Council: Manhole covers and frames, gully gratings and frames; engineers' sundries and tools; iron, nails, screws, etc. Documents from the Borough Engineer and Surveyor, Town Hall, Ilford. A fee of 1s. for each form is required. Tenders by January 6.

KERRIER, CORN.—Stithians water scheme (first instalment). Contract No. 2, on fixed price basis, for Rural District Council. The supplying, excavating for, laying, jointing, maintenance, and ancillary works, for about 13 miles of spun-iron mains with flexible joints, as follows: Approximately 1,200 yd. of 8-in. diameter; approximately 6,050 yd. of 6-in. diameter; approximately 8,250 yd. of 4-in. diameter; approximately 7,690 yd. of 3-in. diameter. Documents from W. J. Thomas, clerk, Council Offices, The Willows, Helston, Cornwall, after December 18. Deposit £5 (cheque payable to the Rural District Council.). Tenders by January 22.

PLYMPTON ST. MARY, DEVON—Laying and supplying of pipes and fittings for approximately 1,140 yd. of 4-in. diameter and 820 yd. of 3-in. diameter class C spun-iron water main at Venton, near Plympton and Dunstone, near Yealmpton, respectively, for Rural District Council. Documents from the Engineer and Surveyor, Council Offices, Plympton. Deposit £2 2s. Tenders by January 15.

LINDSEY—The following required for the year ending April 1, 1959, for County Council: Tools, implements, etc.; steam and diesel rollers. Documents from County Surveyor, County Offices, Lincoln. Tenders by January 8.

WAREHAM AND PURBECK, DORSET—Provision and laying of half a mile of 4-in. spun-iron and asbestos-cement rising mains. Documents from the engineer and surveyor, Arthur G. Flatt, chartered civil engineer, Westport House, Wareham. Deposit £10. Tenders by January 9.

Latest Foundry Statistics

Light-alloy Castings. The Ministry of Supply reports that the output of aluminium castings during September was 1,797 tons from sand moulds, 3,777 tons was gravity-die and 1,561 tons was pressure-die-castings. The production of magnesium-alloy castings during this month was 200 tons.

Spermolin

(REGISTERED TRADE MARK)

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CREAM
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DRY STRENGTH
PERMEABILITY
LACK OF FUME
SMALLEST PERCENTAGE
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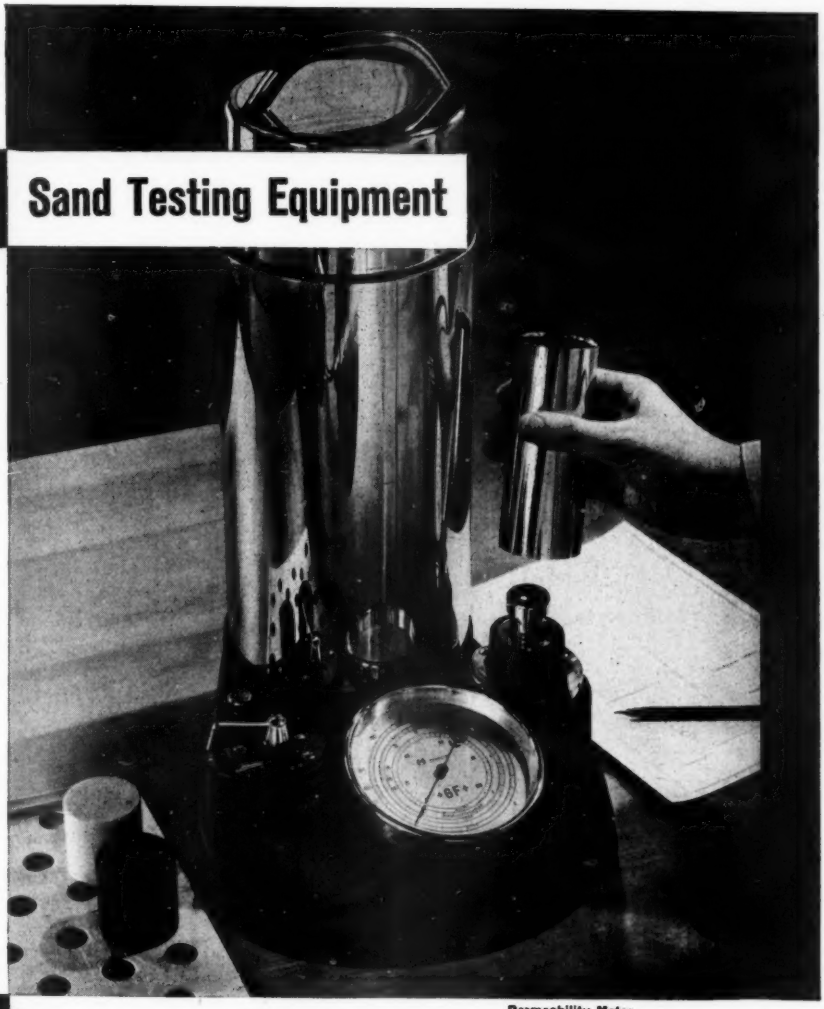

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BRADLEYS BASIC REFINED is produced by a newly developed process utilising basic lined furnaces and operating with a wholly basic slag.

BASIC REFINED IRON is specially suitable for Nodular or Spheroidal Graphite Iron, Roll Making, Steel Making, Carburising Iron and all processes requiring an exceptionally pure cast iron.

- TOTAL CARBONS in "B.B.R." are normally available from 3·2% to 4·0%. In certain cases specifications for Carbons in excess of 4·0% can be met. In all cases Total Carbon contents are determined by the Volumetric combustion method utilising solid or chilled samples.
- SULPHUR contents in "B.B.R." normally range between 0·004% and 0·02%. Specially low sulphurs determined within the limits of accuracy of B.S.I. Method (Specification No. 1121, Part I, 1943) can be guaranteed.
- PHOSPHORUS contents of "B.B.R." normally range from 0·04% to 0·50% according to requirements. Specifications of less than 0·04% can be met under certain circumstances.
- SILICON and MANGANESE contents are supplied to specification. Silicons normally range from 0·20% to 3·0% and Manganese from 0·30% to 1·5%.
- RESIDUAL ELEMENTS. Control is exercised over the whole range of residual metallic elements through our Spectrographic Laboratories and Certificates of Analysis can be supplied with every consignment.

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DARLASTON · STAFFORDSHIRE

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with outside gun and turntable

The picture shows a Hydro-Blast plant having power operated turntable and outside gun with " in ", " out " and swivel movements. This is an ideal combination which permits the thorough cleaning of many castings, entirely from outside the room. And it is all done so very easily, under ideal conditions for the least cost per ton. Any user will confirm that this is so and also that with Hydro-Blast, dust is entirely eliminated.

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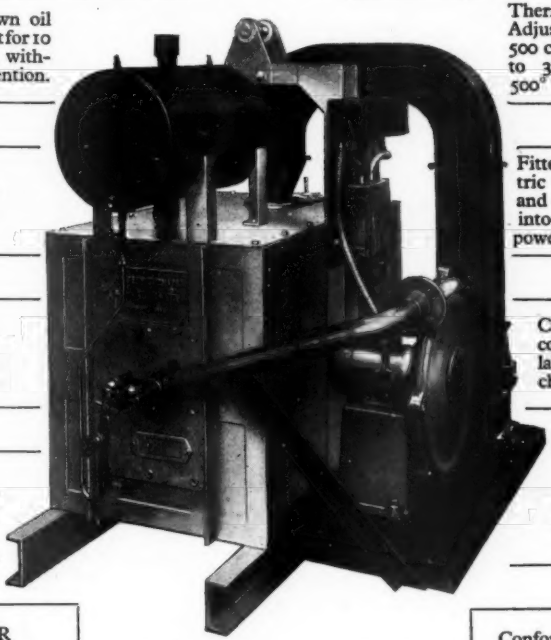

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No smoke or fumes.

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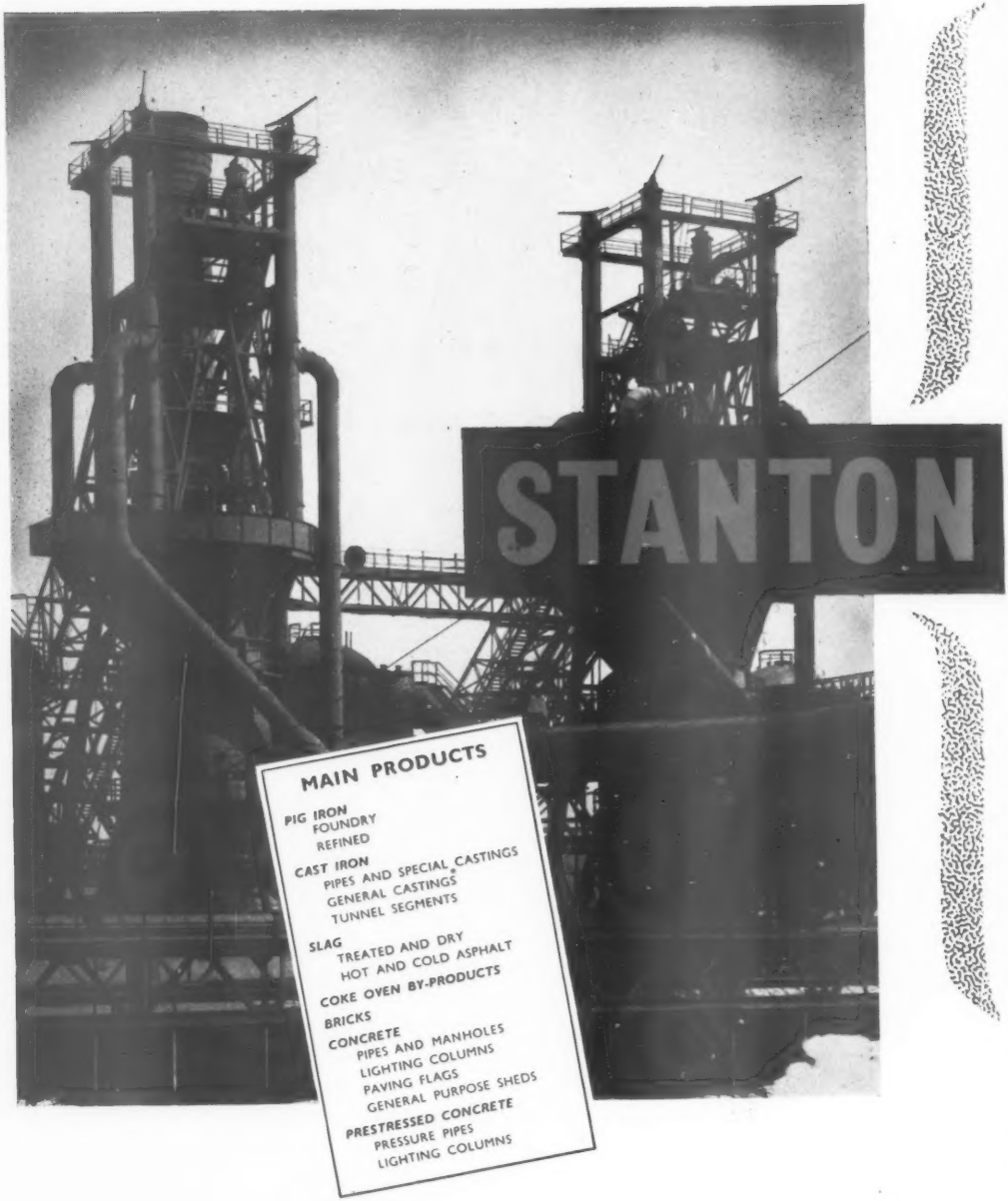

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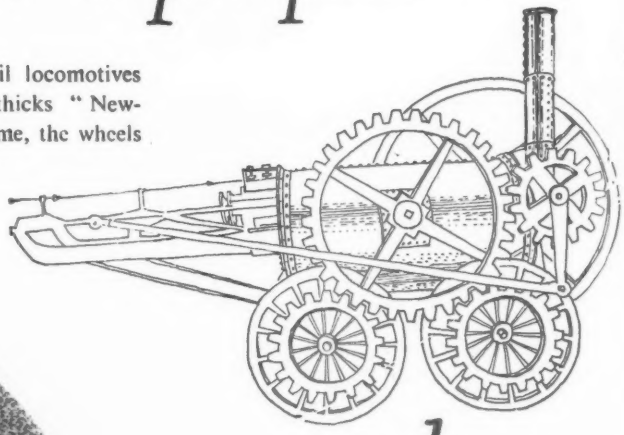

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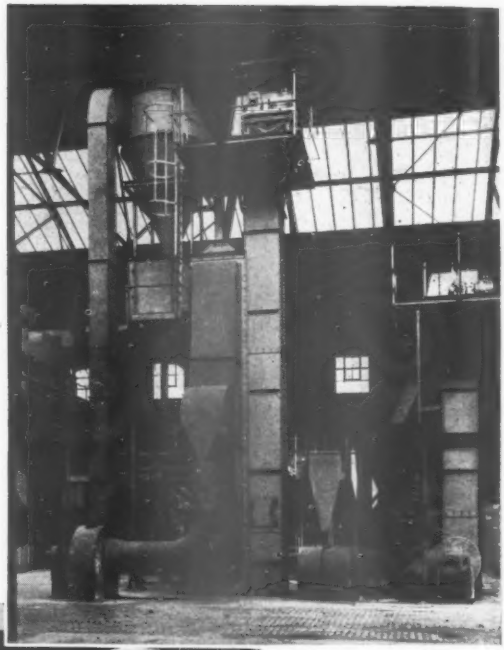

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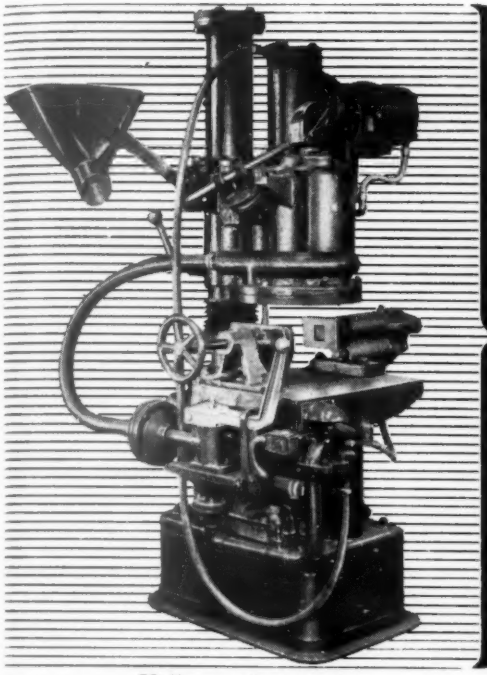

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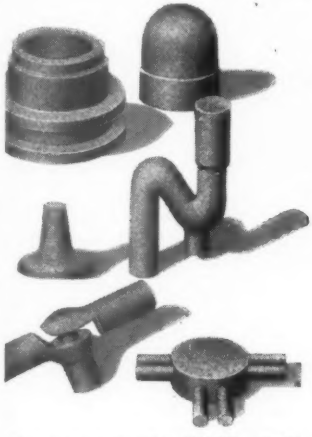

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OUTPUT

220 D performs automatically one complete operational cycle in 15 seconds minimum—produces up to 240, repeat 240, cores per hour, with only one operator.

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220 D can handle core boxes up to maximum exterior dimension of 36in. long by 22½in. wide by 11½in. deep.

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220 D is 5½ tons of precision machinery engineered for continuous production; completely British made at our Leighton Buzzard Works; designed and built for the World's top level foundries.

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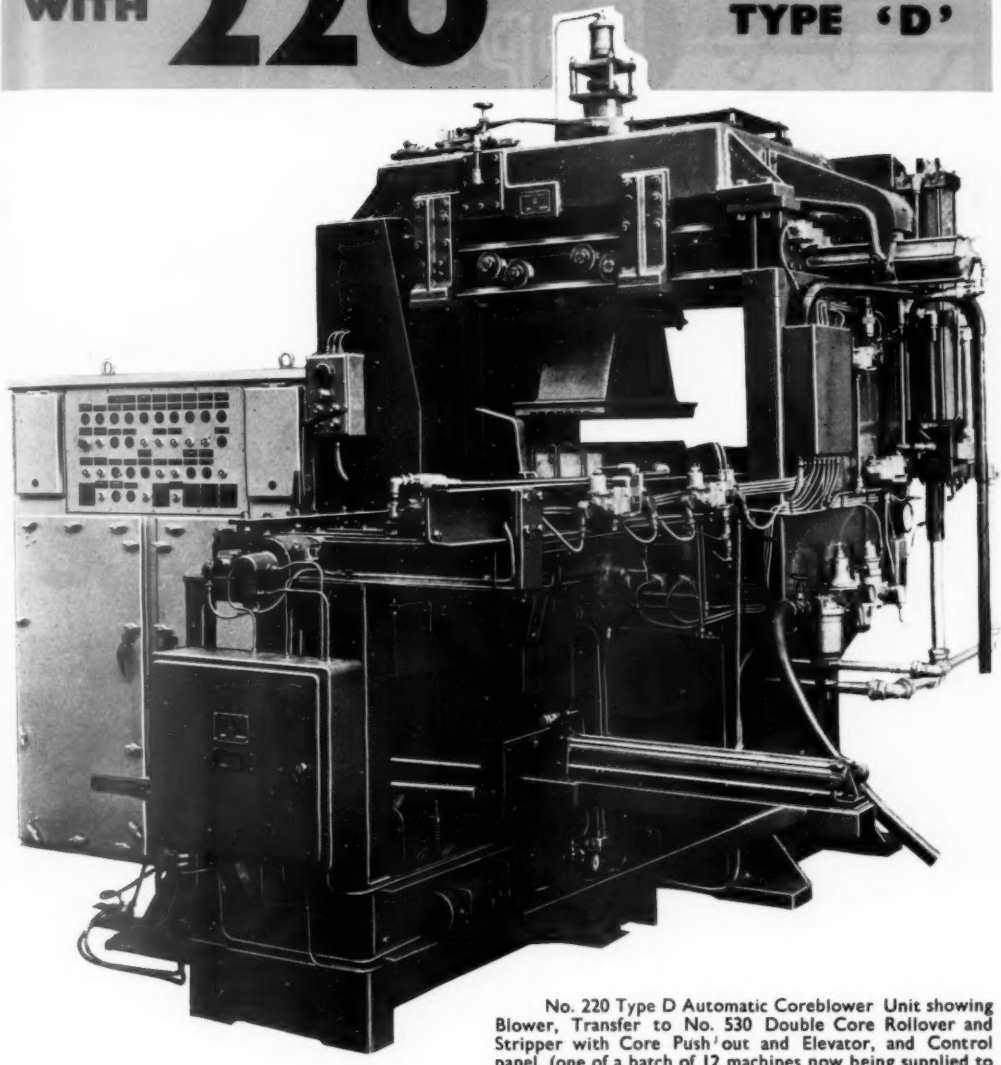

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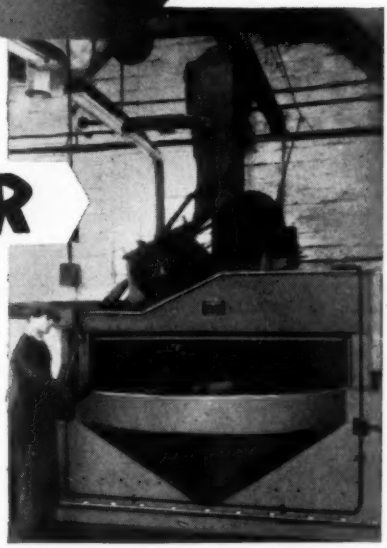

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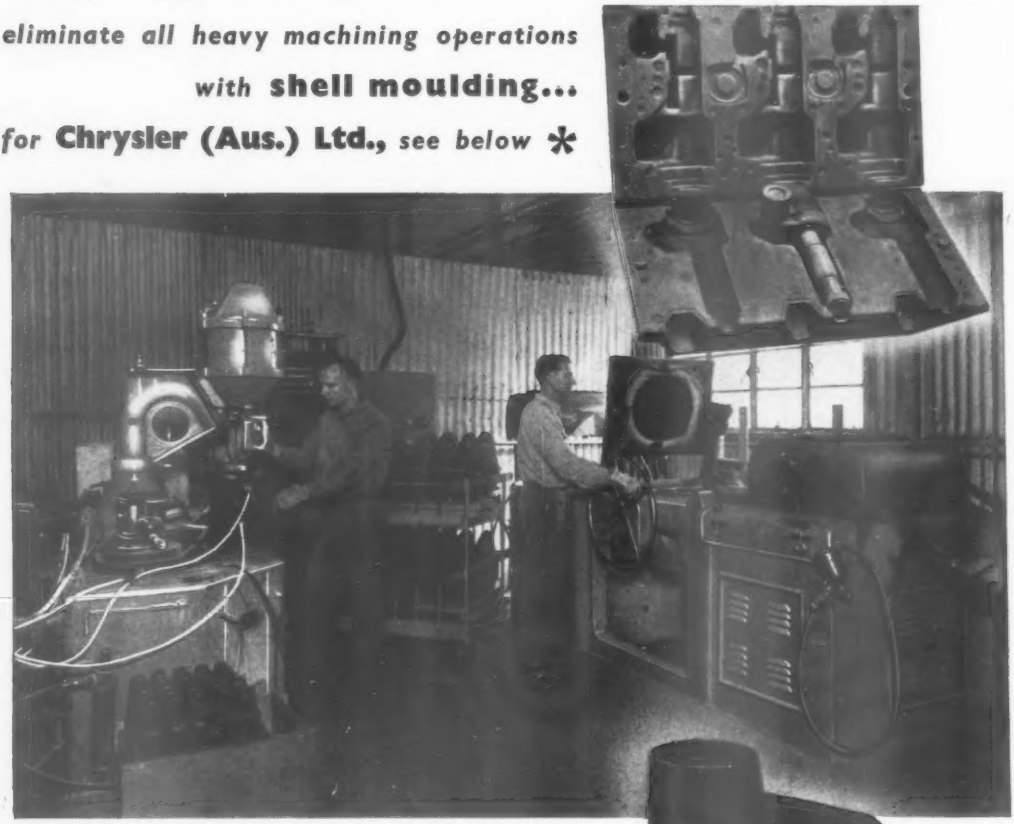
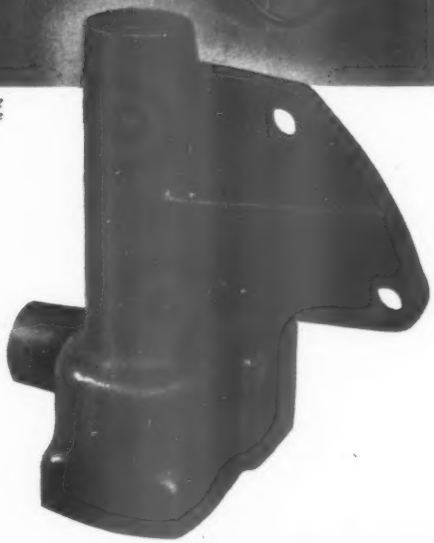
***eliminate all heavy machining operations with* shell moulding...**

***for* Chrysler (Aus.) Ltd., *see below* ***



Photograph of a general view of Polygram Shell Moulding and Core Making Equipment installed at Perry Engineering Co. Limited, Adelaide, Australia. The moulding machine is seen producing shell moulds for car brake drums.

* Illustration at right (reproduced by courtesy of Perry Engineering Co. Limited is of a malleable iron steering box casting, and above is the open 24in. by 20in. Shell Mould. These shell moulded automotive parts are manufactured in large quantities for Chrysler (Aus.) Limited; heavy machining is eliminated and good balancing characteristics achieved by greater accuracy of casting.



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1958 Conveying—

Photograph shows:
The August's Mould Conveyor (closing to pouring, to cooling to shakeout), which is a unit of the large August's Mechanised Sand Plant.

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Photograph by courtesy of THE INTERNATIONAL HARVESTER CO. OF G. B. LTD. DONCASTER

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August's LIMITED

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JJM

Increases in Capital

BARTON & SONS, LIMITED, Dudley, increased by £1,000,000, in 5s. ordinary shares, beyond the registered capital of £1,500,000.

COLEY BROS. (TOOLS), LIMITED, Birmingham, increased by £10,000, in £1 ordinary shares, beyond the registered capital of £30,000.

AVIATION TOOL COMPANY, LIMITED, engineers, etc., of Hampton Wick (Middx), increased by £29,900, in £1 ordinary shares, beyond the registered capital of £100.

PLEWS & TURNER, LIMITED, engineers and ironfounders, etc., of Elland (Yorks), increased by £12,000, in £1 ordinary shares, beyond the registered capital of £3,000.

NEEDHAM BROS. & BROWN, LIMITED, iron and brass founders, etc., of Barnsley, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £10,000.

H. HEWINS, LIMITED, founders, toolmakers, etc., of Brimscombe (Glos), increased by £25,000, in £1 ordinary shares, beyond the registered capital of £25,000.

KAYES (MIDDLESBROUGH), LIMITED, tool merchants, etc., of Middlesbrough, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £10,000.

WHITES-NUNAN, LIMITED, mechanical engineers, etc., of Manchester, increased by £100,000, in £1 ordinary shares, beyond the registered capital of £100,000.

N. GREENING & SONS, LIMITED, wire manufacturers, etc., of Warrington, increased by £500,000, in 5s. ordinary shares, beyond the registered capital of £1,100,000.

GILBERT & KELLETT, LIMITED, engineers, etc., of Barrow-in-Furness (Lancs), increased by £10,000, in £1 ordinary shares, beyond the registered capital of £20,000.

C. H. EDWARDS, LIMITED, brassfounders, etc., of Millfields, near Wolverhampton, increased by £50,000, in £1 ordinary shares, beyond the registered capital of £50,000.

F. GRAUCOB, LIMITED, manufacturers of automobile machines, etc., of Elland (Yorks), increased by £60,000, in £1 ordinary shares, beyond the registered capital of £120,000.

BROOKES, WARD & COMPANY, LIMITED, art metal manufacturers, etc., of Birmingham, increased by £21,000, in £1 ordinary shares, beyond the registered capital of £15,000

TURNER & NEWALL, LIMITED, Manchester, increased by £10,000,000, in 3,333,705 ordinary and 6,666,295 unclassified shares of £1, beyond the registered capital of £20,000,000.

BRAHAM, PATTERSON & BENHAM, LIMITED, mechanical engineers, etc., of Enfield (Middx), increased by £170,000, in ordinary shares, beyond the registered capital of £80,000.

NEWMAN & WATSON, LIMITED, sanitary, heating, and electrical engineers, etc., of London, N.W.6, increased by £99,900, in £1 ordinary shares, beyond the registered capital of £100.

T. MORLEY & COMPANY, LIMITED, stampers, piercers, and die-sinkers, etc., of Birmingham, increased by £54,000, in £1 ordinary shares, beyond the registered capital of £6,000.

ALFIS FABRICATIONS, LIMITED, domestic hollow-ware manufacturers, etc., of London, W.C.1, increased by £20,000, in £1 ordinary shares, beyond the registered capital of £5,000.

TACK AIR CONDITIONING, LIMITED, London, S.W.1, increased by £40,000, in 20,000 "A" ordinary and 20,000 "B" preference shares of £1 each, beyond the registered capital of £60,000.

JOHN LUND, LIMITED, machine-tool makers, etc., of Cross Hills, near Keighley (Yorks), increased by £100,000, in £1 ordinary shares, beyond the registered capital of £150,000.

HOLMAN BROS., LIMITED, mining and allied equipment manufacturers, etc., of London, W.1, increased by £1,076,000, in 10s. ordinary shares, beyond the registered capital of £424,000.

H. BURLINGHAM & COMPANY, LIMITED, agricultural merchants and engineers, etc., of Evesham (Worcs), increased by £22,500, in £10 ordinary shares, beyond the registered capital of £18,500.

INSTANT STARTER ENGINEERING COMPANY, LIMITED, London, W.1, increased by £99,900, in 1s. ordinary shares, beyond the registered capital of £100. The company was made public on June 18, 1957.

CLARKSON (ENGINEERS), LIMITED, milling chuck and cutter manufacturers, of Nuneaton (Warwickshire), increased by £490,000, in 5s. ordinary shares, beyond the registered capital of £10,000.

QUICKTHO (1928), LIMITED, London, E.C.2, increased by £625,000, in 3,750,000 ordinary shares of 2s. and 250,000 redeemable preference shares of £1 each, beyond the registered capital of £125,000.

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FOUNDRY WORKS MANAGER, age 47, resident Birmingham area, seeks similar position, or General Manager small firm. Preferably Midlands. Consulting experience, mass production and jobbing up to 30 tons. Ferrous and non-ferrous. Fully qualified. Box FW282, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

EAST MIDLANDS Iron Foundry require ASSISTANT METALLURGIST for technical control of high duty irons. Box EM269, FOUNDRY TRADE JOURNAL.

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For the quality of work involved technical education to H.N.C. standard is essential with some experience either in:—

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(*b*) Design of dies for plastic moulding or die casting; or

(*c*) Design of metallurgical plant.

Pension scheme and other staff benefits.

Please write with full details of experience to the Personnel Manager at Hayes, Middlesex.

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SITUATIONS VACANT—*contd.*

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Box. AW 270
FOUNDRY TRADE JOURNAL

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A substantial salary will be paid, fully in keeping with the responsible nature of the job and the qualifications and experience required. Assistance may be given with housing.

Apply with full particulars to:

PERSONNEL MANAGER,
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The plant concerned is producing brass and copper sheet and strip, and applicants must be fully conversant with modern rolling mill practice, and preferably have had some experience in a supervisory capacity on this type of work.

Good salary and long-term prospects will be available to the successful applicant, and a superannuation scheme is in operation.

Applicants should give age and full details of experience and qualifications.

Write Box SF.279, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*contd.*

FOREMAN required for large Steel Foundry in North-West Area. Knowledge of heavy jobbing working essential; shift work.—State age, experience, and salary required to Box FR271, FOUNDRY TRADE JOURNAL.

METALLURGIST, aged 25/35 years, with appropriate qualifications, required by firm of Ironfounders and Agricultural Engineers. Good post for suitable man. State age, qualifications, experience, and salary required.—BAMFORDS, LTD. Uttoxeter, Staffs.

FOUNDRY DEPUTY FOREMAN wanted for Grey Iron Foundry in West Riding, with Machine Moulding (Semi-skilled) and Bench and Floor Moulding (Skilled). Suitable man, to eventually take complete charge.—Apply by letter, stating age, experience, qualifications, and salary required.—Write C., 74, News Office, Keighley, Yorks.

OLD established firm of Ironfounders in the Manchester area, anxious to secure the continuity of their Business, seek additional DIRECTOR, with experience in the Iron Foundry Business. Excellent prospects open to a person willing to accept full share of responsibility. Box OE286, FOUNDRY TRADE JOURNAL.

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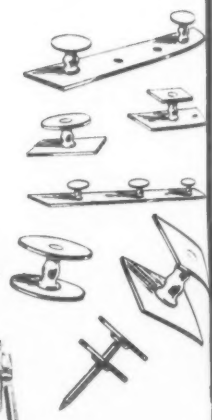

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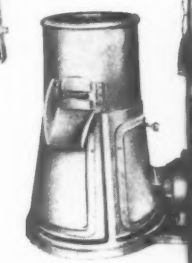

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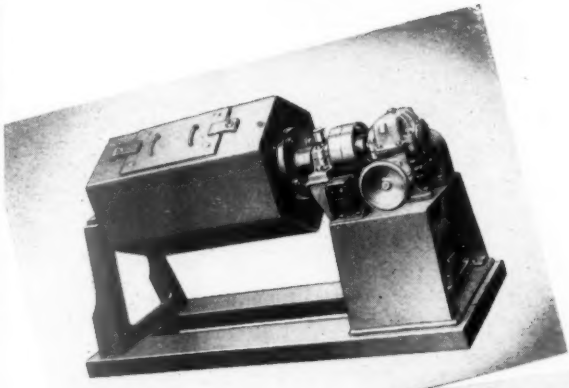

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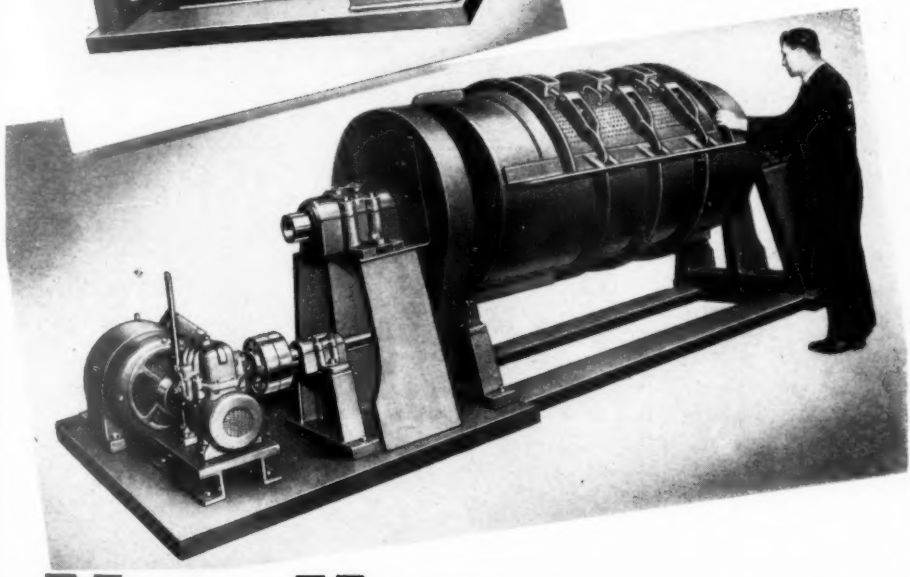

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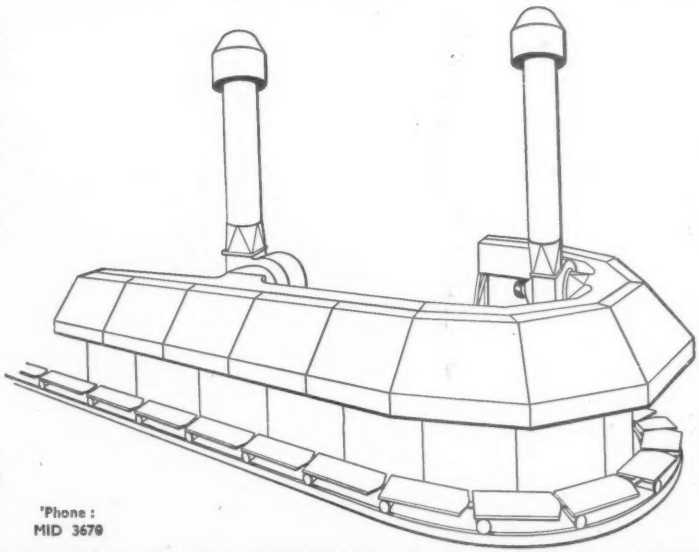

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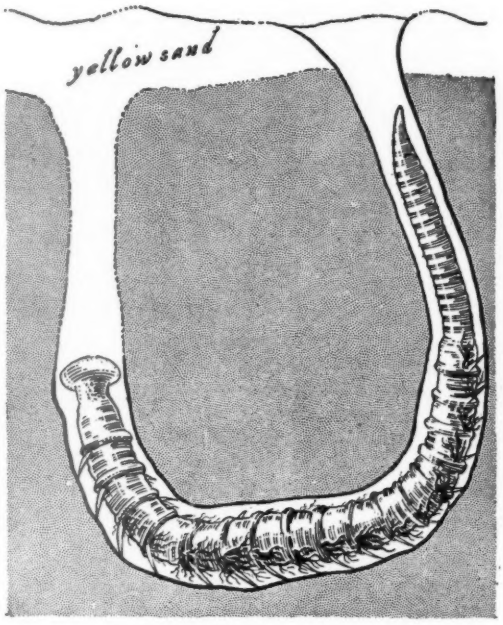

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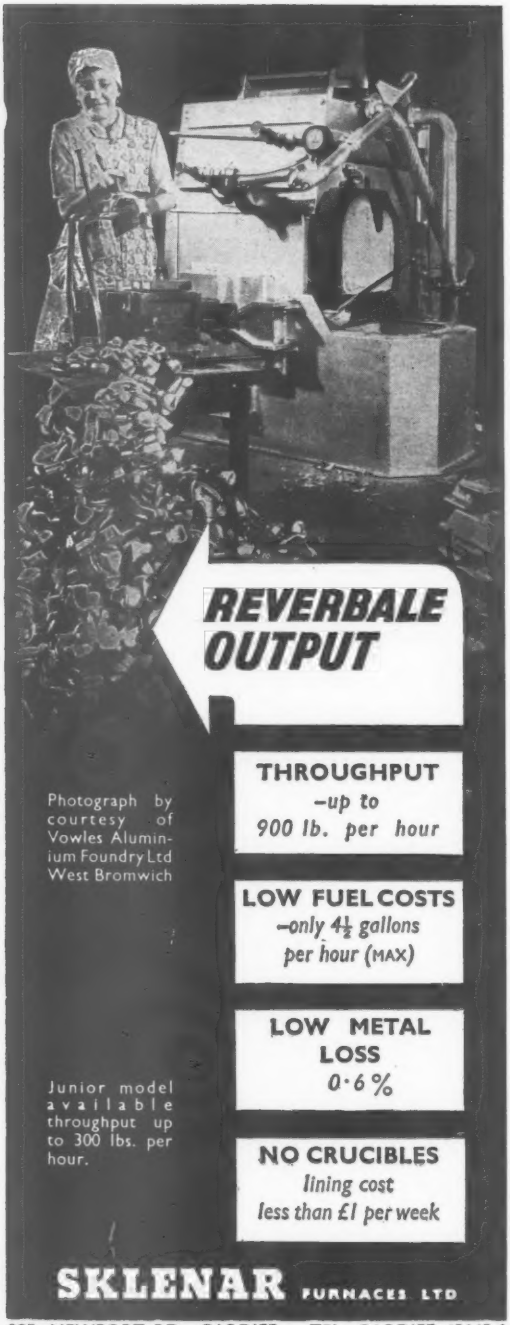

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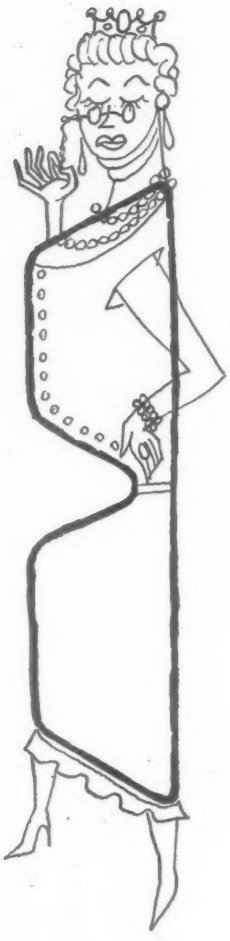

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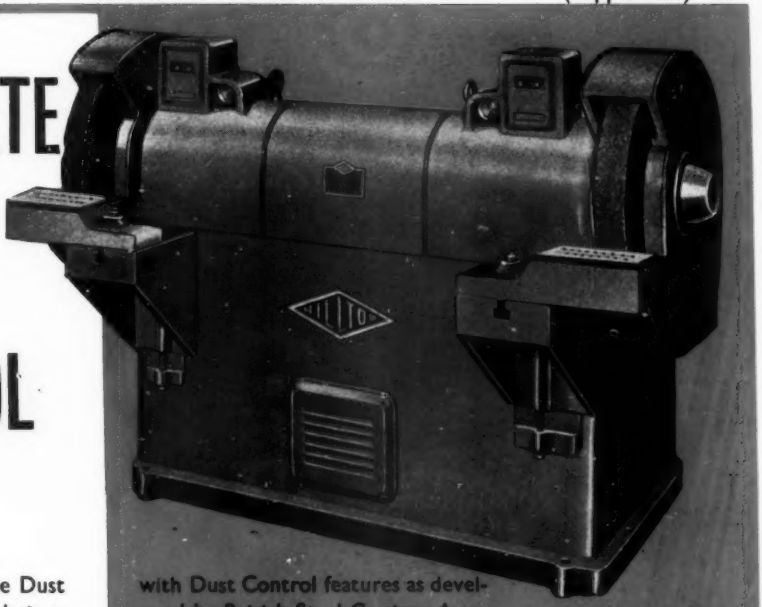

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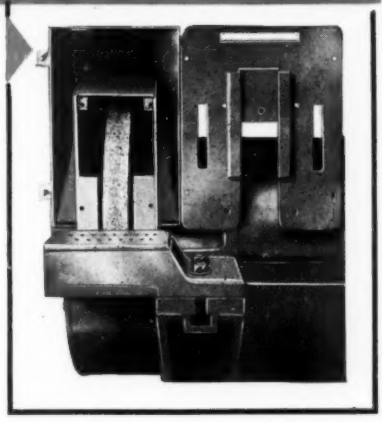

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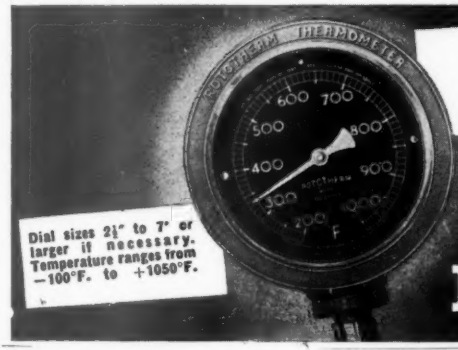

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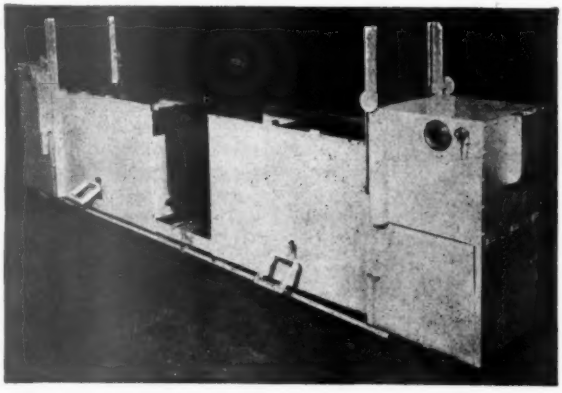

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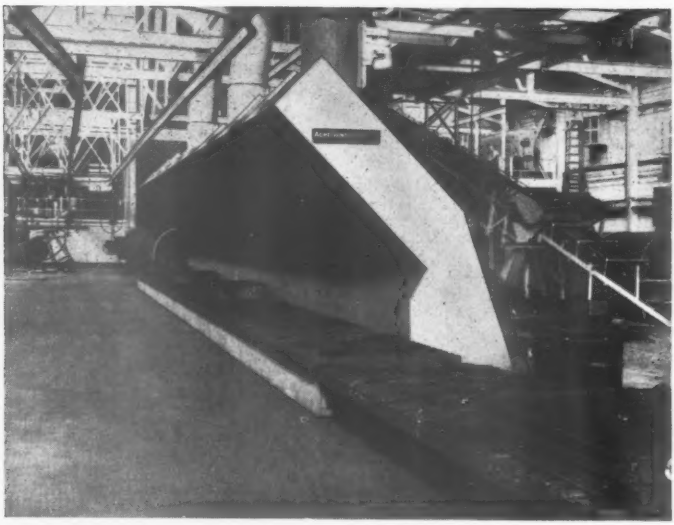

This is a photograph of a typical Acme Installation. From right to left it shows a Troughed Belt Conveyor from Shake-out, Magnetic Separator, Fume Extraction over Mould Conveyor and Pouring Monorail.

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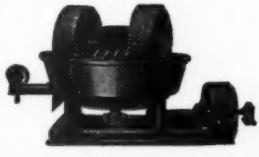

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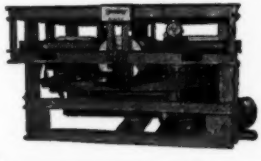

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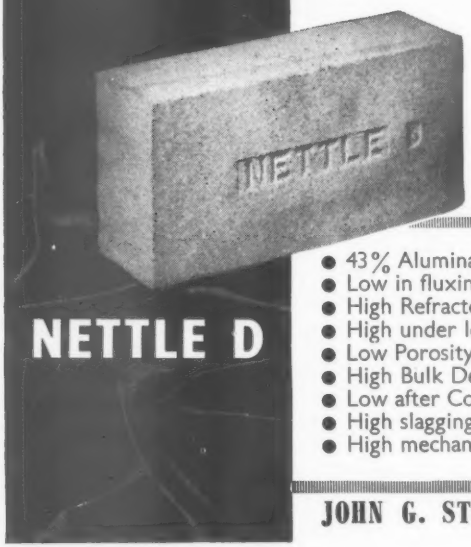

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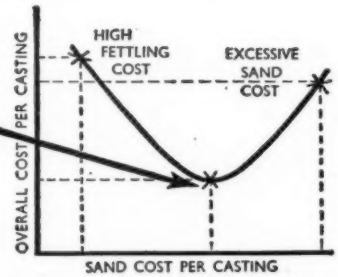

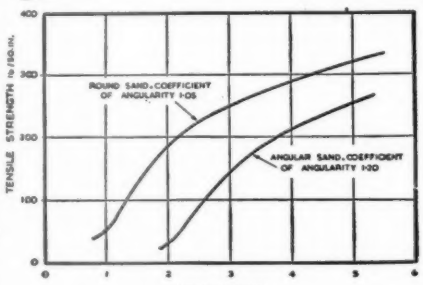
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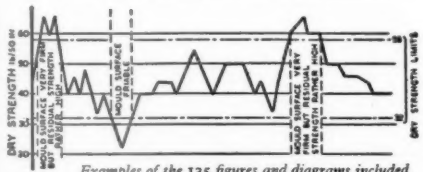

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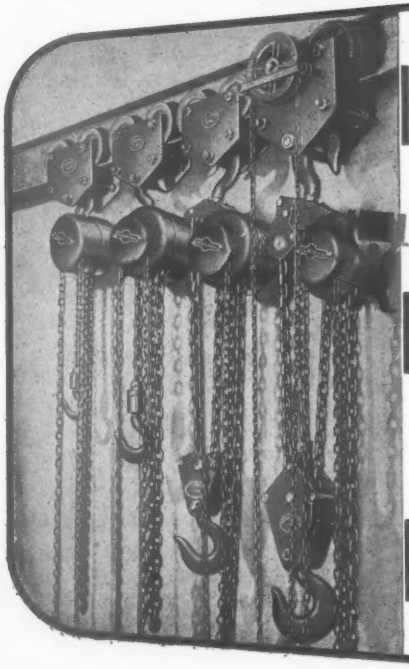

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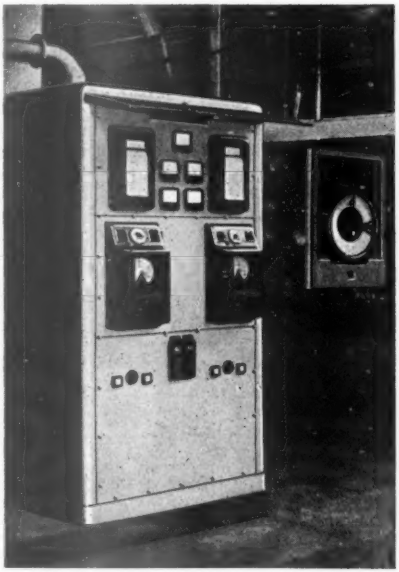

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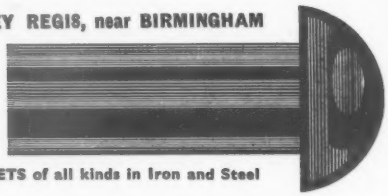

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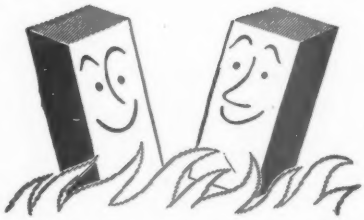

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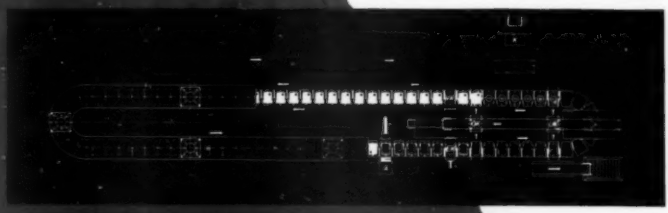

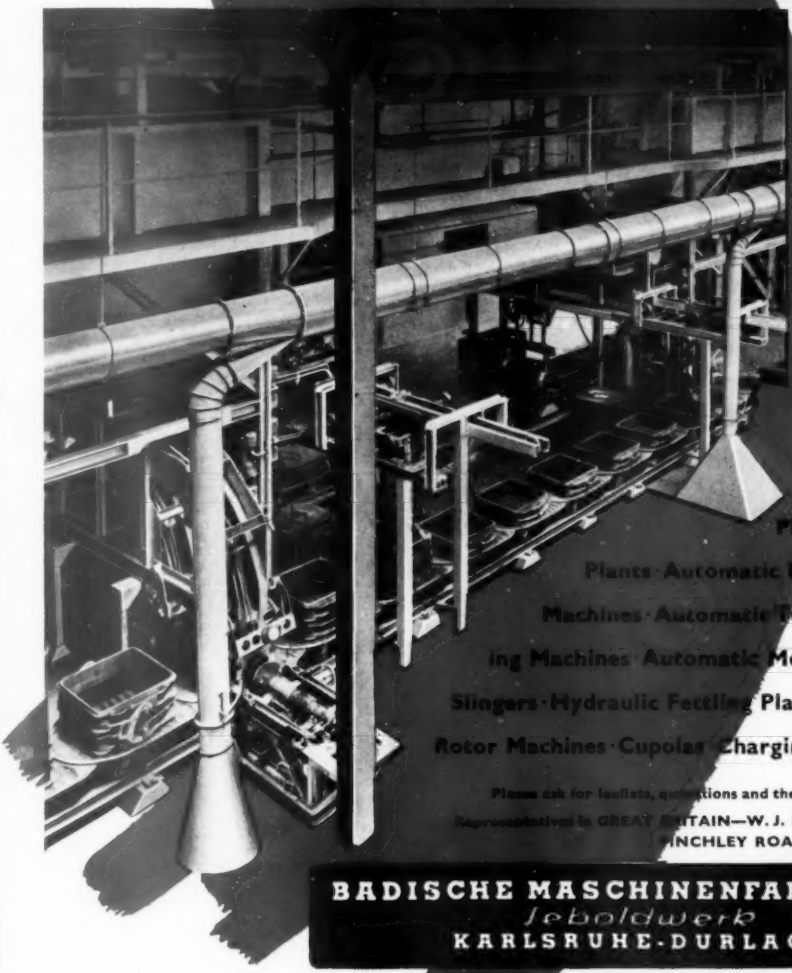

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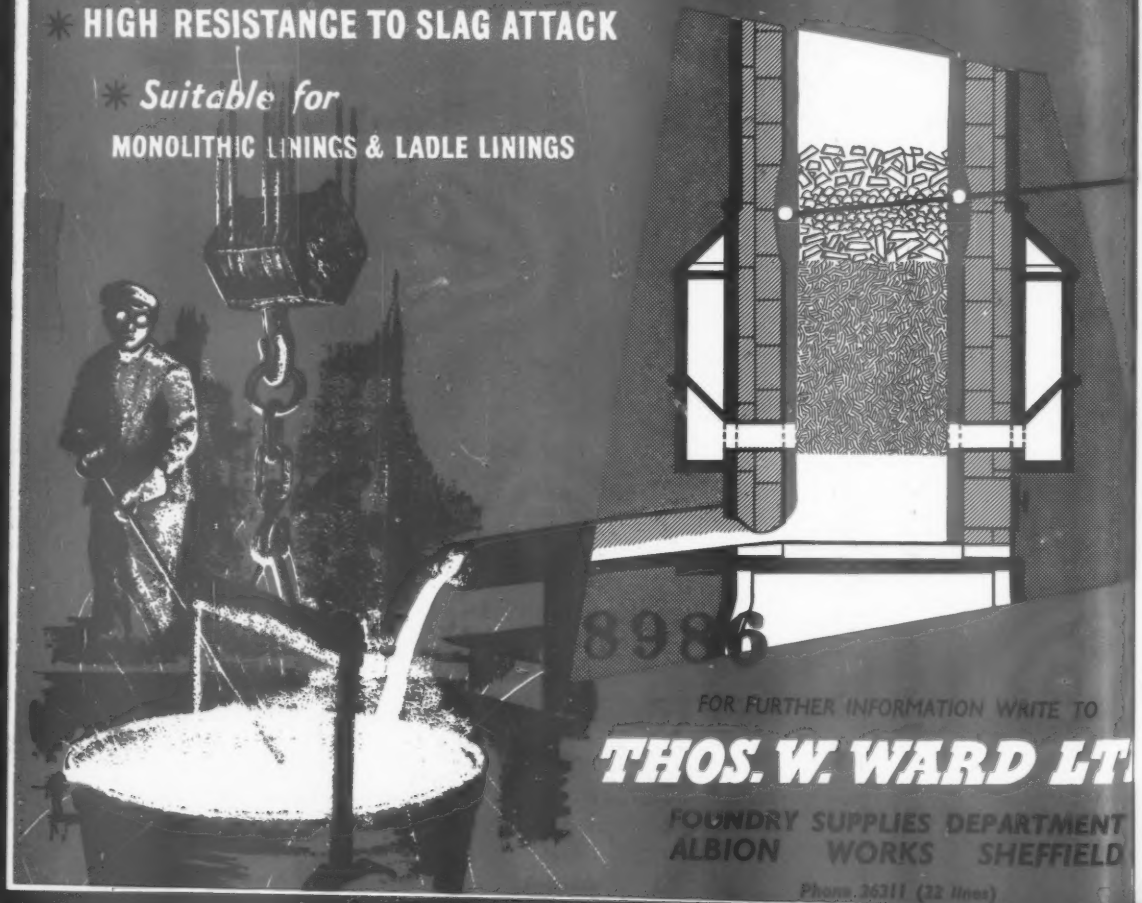

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